# FRANKLIN

National Facility
Oceanographic Research Vessel

## RESEARCH SUMMARY

## FR 3/92

| | | | |
|---|---|---|---|
| Sailed | Townsville | 0630 hrs | 1 April 1992 |
| Called | Gove | 0700-2030 hrs | 16 April 1992 |
| Arrived | Townsville | 0800 hrs | 28 April 1992 |

## GREATER AUSTRALASIAN SHELF PRODUCTIVITY STUDY (GASPS) - 1

**Principal Investigators**
Dr. Miles J. Furnas
Dr. Daniel Alongi
**Australian Institute of Marine Science**

Dr. T. David Waite
**Australian Nuclear Science and Technology Organization**

May 1992

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AUSTRALIA

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## CRUISE FR 3/92

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## GREATER AUSTRALASIAN SHELF PRODUCTIVITY STUDY (GASPS) - 1

Productivity and vertical fluxes of carbon, nutrients and trace metals in northern Australian continental shelf systems.

**Principal Investigators**

Dr. Miles J. Furnas
Dr. Daniel Alongi
**Australian Institute of Marine Science**

Dr. T. David Waite
**Australian Nuclear Science and Technology Organization**

**Scientific Objectives (on departure):**

1. Measure primary production in shelf waters bordering northern Australia as a model for low latitude, non-upwelling continental shelf systems.

2. Measure concurrent sedimentation of carbon, nitrogen, phosphorus and trace metals from the water column to the benthos.

3. Make measurements of the concentration and speciation of biologically important trace metals in shelf waters.

4. Collect water, particulate matter and sediment samples for quantification of particle residence times in the water column using short lived natural radioisotopes (234Th).

5. Measure rates of benthic metabolism ($O_2$ consumption, nutrient release) and determine porewater profiles in sediments at experimental sites on the northern shelf.

**Objective added en route:**

6. Measure response of plankton community to disturbance by a tropical cyclone on an open continental shelf.

**Scientific Personnel:**

**Australian Institute of Marine Science**

Miles Furnas (Chief Scientist)
Michelle Skuza
Adam Goldrick
Paul Christoferson
Otto Dalhaus
Irena Zagorski

**Australian Nuclear Science and Technology Organization**

T. David Waite (departed Gove)
Ron Sczymazk

**University College of Central Queensland**

Quentin Espey (departed Gove)
Mark Robertson (embarked Gove)

**CSIRO - ORV**

David Vaudrey (Cruise Manager)
Phil Adams
Gary Critchley

**General Overview:**

Time series stations were occupied at four sites. The first series of stations in the Timor Sea was abandoned after 36 hours with the development and approach of cyclone Neville (central pressure 960 hPa) from the east. *Franklin* retrieved all sediment traps and skirted around the northern side of the storm. Neville's track eventually went right over the top of our Timor Sea time series station. The benthic group was unable to collect sediment due to the loose nature of the sediment.

The second time series station was occupied just north of the Coberg Peninsula. Cyclone Neville formed at or very near this site and one primary production station was occupied nearby on the voyage outward to the Timor Sea. This station was occupied in lieu of the time series station planned for the Arafura Sea. Upon arrival the water was quite churned up, with large amounts of suspended sediment. Over the next five days, daily drifting sediment trap deployments were carried out. The suspended material settled out of the water column and an extensive phytoplankton bloom developed. The moored traps contained relatively large amounts of resuspended carbonate muds. After considerable

trying, the benthic group was able to obtain sufficient box cores for metabolism measurements. The ANSTO/UCCQ group carried out a number of experiments regarding iron concentrations, speciation and diel changes in speciation.

The ability to get into the area affected by the cyclone gave us a unique opportunity to examine the biological and geochemical consequences of a strong disturbance of this nature on a tropical shelf system.

All sediment traps were recovered and the *Franklin* proceeded to Gove to take on water and exchange personnel for the second half of the cruise, then proceeded to the third time series station in the center of the Gulf of Carpentaria.

The third time series station was occupied in the central Gulf of Carpentaria for 72 hours under good weather conditions. Iron speciation experiments were continued. No trouble was experienced with sediment traps. Traps ca. 20 m off the bottom had little apparent re-suspended material, but the moored traps ca. 5 m off the bottom were full of re-suspended muds.

After recovering all sediment traps, *Franklin* proceeded northward and passed back through the Torres Strait to a site in the Gulf of Papua approx nautical 50 miles E of Bramble Cay. Three drifting trap deployments were carried out in the region. The ship moved around in the general area, trying to find bottom suitable for box coring. Most sites had sediment dominated by *Halimeda* gravels, which were unsuitable for coring.

After picking up all moored and drifting traps, *Franklin* proceeded to Townsville, occupying one primary production station in the deep Coral Sea.

Overall, forty-four (44) hydrocasts were made (attached table) and nineteen (19) primary production experiments were carried out. Eleven (11) deployments of the drifter sediment traps were made. Eleven (11) subsurface light profiles (scalar PAR) were measured. Benthic metabolism was measured five (5) times at at three (3) sites. Pore water profiles were measured at two additional sites. Near surface iron concentration and speciation measurements were made at most primary production sites when conditions were suitable to launch the zodiac. Two diel iron speciation studies were carried out.

## Cruise Narrative

### 1 April, 1992

Departed Townsville - 0630. Overcast and spots of rain. Headed northward through GBR lagoon. Days activities - unpacking and organizing gear. Discovered that the hard disk on the old IBM was wiped clean, taking all of the JED logger programs with it.

**2 April, 1992**

Morning production station just south of Cape Melville in the shipping channel (TIM001). The usual running around for a first station. Continued northward up the channel. Deployed Zodiac for metal sampling just north of Stanley Island (Flinders Group) just after lunch. Old IBM packed up again. Won't boot. Kludged logging program for JED on one of the KT laptops. Phil Adam's adjusted analogue input on the JED logger to get it back on scale. Weather blowey.

**3 April, 1992**

Morning production station just south of Cape York (TIM002). Water seems murky. Wind blowing 20+ kts so not surprising. People starting to get into routine of hydro station. Went through Torres Strait with a 3 kt tail current and out the other side. After dark, Neil reported patches of bioluminescence. Started new light logging program running. Scintillation counter jammed mechanically.

**4 April, 1992**

Can't restart scint counter with minor pokings and proddings. Seems to jam and lose counts. Samples waiting. Morning production station (TIM003) in NW Gulf of Carpentaria. 20 kts of wind. Overcast, no light profile. Zooplankton tows with lots of bugs and *Trichodesmium*. Collected sediment sample with van Veen grab. Greenish calcareous mud. Little or no macrofauna or forams. Mud feels greasy in texture. Took samples for CNP, grain size analysis. Ship's air conditioning on and off. GP lab down below sometimes a sauna. Not too bad topside.

**5 April, 1992**

Weather cloudy and rainy. A diffuse low has settled in north of Land and we are in it. Ship making good time. Morning production station (TIM004). The mud caught this time was greyer, a bit sandier and lacked the greenish cast of the previous station. No obvious macrofauna, but calcareous in nature. Weather too rough for deploying the rubber duck. Water has a non-blue, chalkish cast to it, but it is hard to say whether it is the water or the clouds. Doesn't look ocean oligotrophic blue though. Work going well. The scint counter packed up again, but Phil dismantled it and after several attempts, finally got it going. It appears to be associated with the mechanical adjustment of the microswitches at the back of the sample deck. They were a bit out of alignment. It is a pain though to dismantle the whole thing to twiddle them back into shape.

**6 April, 1992**

The weather has come good at last. Clear and sunny, light seas. Headed SW into the station west of Darwin. Should be there around 2-3 pm local time. No major equipment dramas in the am. Morning station (TIM005) at 10 am.

Arrived on station at 1430 local time. Deployed drifter trap, did hydro station and tried box coring. Lots of trouble with coring. Numerous failures, few if any intact cores.

Abandoned for the day. Tropical low north of Arhnem Land upgraded to Cyclone Neville. Direction uncertain. Lots of floating *Sargassum* - largish petals. Schools of swimming *Portunid* crabs through the night around ship. Ron Sczymack pumped all night. His magnetic pump lacked guts, so took water through ship's fire mains to test things out.

**7 April, 1992**

Weather lovely. Flat glassy calm in am. Did hydro station for production (TIM008), light cast after lunch. Duck away, then another hydro and picked up drifter at 1500. Took two tries to get over the transom. Resistance to pull up sufficient to straighten out the grappling hook. Lots of brownish fine sediment in traps. Looks like resuspended benthic fines. More attempts to core after the trap re-deployed. More success at getting cores, but all were sufficiently disturbed to preclude bell jar work, so all were sacrificed for pore water sampling. Ron and Dave rebuilding pumping manifold with AIMS Mono pump to get more push. Neville deepening (980 mb) and heading SSW toward Coburg Peninsula. Winds up to 30 kts plus while doing midnight station.

**8 April, 1992**

Neville is heading our way and has deepened to 972 hPa. Traps pulled out at 0630 and *Franklin* starts making a run around the northern perimeter of the storm. Both the trap deployments cactus. It would appear that somewhere along the way, we touched bottom and caught a lot of resuspended material in the traps. Our digression will take us into Indonesian waters, so no work while underway.

**9 April, 1992**

Rainy and overcast. Will cross into Australian waters around noon local time and reach a spot where the cyclone developed around 6 pm. Neville now 945 hPa, with winds to 100+ kt and going over our old experimental site. Planning to work in an area affected by the cyclone for several days. Ship moving along nicely and we are catching up on data entry and workup. Ron Sczymack pumped water for $^{234}Th$ all night (9 hrs).

**10 April, 1992**

On station at the site where Tropical Cyclone Neville formed. Deployed two moored traps and one drifter in the am then occupied a primary production station (TIM013). Water a milky blue-green color, most likely from resuspend carbonate mud. Fine clays are clogging $^{14}C$ filters. Box coring went well after lunch. Eight cores obtained in short order for pore water chemistry work. Mud a greenish grey color. Split one core, but no indication of any storm layer. Wind good all day, but picking up in evening. Neville stalled in Timor Sea near our original site. Work going well. The VAX carked it, but we can do without that.

**11 April, 1992**

VAX restarted - The problem appears to have been a dirty connector. Nobody seems to have missed it. Work going along nicely - water column stuff anyway. The water column has cleared a bit. Drifter traps full of fine carbonate mud particles - deployed 20 m above the bottom. Light down to 30 m. Could filter all samples for $^{14}C$ experiment (TIM015). ANSTO people doing iron and other trace metals work. Also studying absorptivity of surface waters using AIMS Hitachi spectrometer. Will start diel sampling for iron studies tomorrow AM. Still too rough for box coring. Tried in pm, but couldn't get undisturbed cores and had to abandon attempt. Spent rest of day following drifter while doing work aboard.

**12 April, 1992**

Situation going well. On site near where Neville formed. ANSTO people did diel sampling experiment. Metals free container proving satisfactory for processing samples for iron work by ANSTO. All gear going nicely. Morning production experiment (TIM017). Clear skies. Following drifter. Benthic people have gotten the hang of the mud and are getting good box cores. Flashing lights on drifter Dan buoy are quitting after about 6-8 hours. Reason unknown. Change at dusk, then they run happily all night.

**13 April, 1992**

Going well. Finished diel experiment with 6 am sampling. Deployment and retrieval of Zodiac now working efficiently. Successful box coring near drifter. Did morning production experiment without a hitch (TIM019). Water looking greener. Recovered drifter and returned to site of moored traps. Moored traps FULL of fine carbonate mud. On return to mooring trap site, passed through a patch of very green water (diatom looking by color). Slightly less green at mooring site, but still much greener than before. Re-deployed drifter at mooring site in late pm. Had to change batteries again after 4 hours, then it ran all night.

**14 April, 1992**

Going well. Did a morning production station (TIM022) Picked up drifter in the pm, did a station and took off for Gove.

**15 April, 1992.**

En route to Gove. Did morning primary production station (TIM024) in the am. Some benthic sampling near Cape Wessel while going past. Lots of small sharks evident.

**16 April, 1992**

Docked at Gove in am. Dave Waite and Quentin Espey departed, Mark Robertson (UCCQ) embarked as part of the ANSTO project. Underway at 2030 for central Gulf of Carpentaria.

**17 April 1992**

Arrived at central Gulf of Carpentaria site around mid-day. Deployed moored traps and drifter without incident. Phytoplankton from net tows full of large *Coscinodiscus* cells. Retrieved and re-deployed drifter at 1600 as the skipper thought the trap was touching bottom, though not in evidence upon inspection of trap. Trap difficult to recover safely (for people and the trap) in rough weather with stern sea. Changed flasher at 1700 when light began getting erratic. BBQ on fantail with a nice fish Gary (Ch. Cook) caught in Gove.

**18 April, 1992**

Diel iron sampling postponed due to rough weather at 0600. Production station (TIM027) and successful box coring completed before lunch. Weather has abated somewhat. Lots of salps in sample. Sediment traps full of *Trichodesmium*, big centric diatoms and large globose radiolarians with symbionts. More damage to traps on recovery. Traps need a wind sock 5 m below the trap to hold the line taught when the trap comes out of the water.

**19 April, 1992**

Recovered and re-deployed drifter trap. More successful box coring today. Did primary production station (TIM 029) Ron and Mark did diurnal run for iron speciation. Seas calmer today and with clear skies, things are looking good. No real problems with equipment or anything of substance.

**20 April, 1992**

Early morning box coring. Recovered drifter trap and did final primary production station (TIM031) in Gulf of Carpentaria. Recovered moored traps. Cups full of mud and some sort of clear spheres - contents looked like grey tapioca pudding. Departed for Torres Strait.

**21 April, 1992**

Underway to Gulf of Papua through Torres Strait.

**22 April, 1992**

Arrived on final station in very early am. Deployed moored and drifting sediment traps east of Bramble Cay in morning and did first Gulf of Papua primary production station (TIM035). Water clear and oceanic blue. Readily measurable light to bottom (65 m). Sediment unsuitable for box coring. *Halimeda* gravel with some mud.

**23 April, 1992**

Recovered drifter during mid-morning. Moved NW to shallower site - ca. 45 m depth to see if we could get out of *Halimeda* gravel area. Moved to several sites in area looking

for corable sediment, but to no avail. Finally deployed drifter in late am (TIM037) and followed overnight. Pumped for Thorium overnight.

**24 April, 1992**

Recovered drifter trap just after breakfast and moved ca. 14 miles NE parallel to front of Fly Delta to try and find better sediment for box coring. Deployed drifter mid-am (TIM040) and did daily production station in ca. 60 m of clear blue water. Sediment sandier and muddier with less *Halimeda*. Started to get decent box cores - at least suitable for pore water measurements. Followed drogue overnight and pumped for Thorium.

**25 April, 1992**

Picked up drifting trap at mid-morning and did final shelf production station (TIM042). Benthic people finally were able to get enough good box cores to do metabolic rates. Sediment muddy sand without much *Halimeda*. Picked up moored traps late morning and did CTD station at site. Traps with little if any resuspended material. Departed site at mid-day for Townsville.

**26 April, 1992**

ANZAC day underway. - Final station (TIM044) of cruise in deep water off the northern GBR. Proceeded through reef near Lizard Island and onward to the south.

**27 April, 1992**

Underway to Townsville.

**28 April, 1992**

Alongside Townsville at 0800. Stevadoring party away.....

**Suggestions for making a great ship even greater.**

The current jury rigged system of putting the incubation baths for primary production experiments on top of the clean container (starboard side) works just fine. What the ship could use is lightweight decks (which would also serve as awnings) to go onto the top of the containers. They could be one piece - big and clumsy, or several pieces that are held together by tensioning bolts/pipes/rods. The deck should overhang the edge of the container a bit and could be fitted with post-holes for a railing (rope/wire lifelines) and tie-down holes or strongpoints for things like incubator baths. An additional feature of great use would be a PVC scupper and downpipe attached to the edge of the decking and trailer, leading to a flexible hose on the deck to collect circulating water and deliver it neatly to the rail for disposal overboard. A small, but decent, detatchable awning for the bio-trailer door would also be a great benefit as water tends to come around the edges of the door in wet weather if it is not dogged down extra tight. This little bit of wet floor is also the place one stands when turning on all the lights/fans. Not safe!!!!! If one is

working on top of the clean container, the flexible skirt covering the join between the container and Chem Lab should be replaced by a rigid cover as the skirt cannot take a person's weight and one can put a foot down into the open space between the container and the superstructure.

The problem of saltwater supplies to the back deck for incubator cooling purposes remains a problem. The BioWater flow is still too low to be useful for incubators. There is plenty of water from the fire hose, but the temperature is continually 3C greater than surface temperatures. This contributes some uncertainty to the interpretation of incubation experiments with surface samples, and may be a real problem for incubating things from cooler, deeper depths. Some sort of external water intake and pump delivering cooling water to the deck would be very useful.

It's great having light in the Met data and with the CTD casts, but raw underwater light readings need to be corrected for overcast and clouds (in particular) to be useful for biology work. Can the CTD logging program be modified to include a surface (mast top) light value with every line of data from the CTD? That would make it possible to unambiguously calculate % surface light for every sample as well as the total downwelling light. In that manner, corrections can be made for isolated drops in total light due to small clouds or overcast. Interpolation from the existing Met data files is not accurate as the CTD will be taking many readings for every one in the Met light data file and U/W light can change within a few seconds.

It would be very useful having one or two inexpensive (?) generic data loggers (connected or not to the ship's data acquisition system) to take advantage of instruments coming aboard with users or ad hoc situations developing aboard. In our case, we have brought a different brand (type) of surface light sensor and felt it would be very useful to compare it's response to that of the ship's light sensor.

When recovering drifting sediment traps or other fragile gear over the stern, the traps should be fitted with a sea anchor or wind sock approximately 10 m below the trap to keep the trap from swinging against the transom when clearing the surface if the ship has ahead way on.

**Acknowledgments**

All scientific personnel wish to thank Neil Cheshire and all members of the crew for their support and assistance with the work carried out.

4 May 1992