FRANKLIN

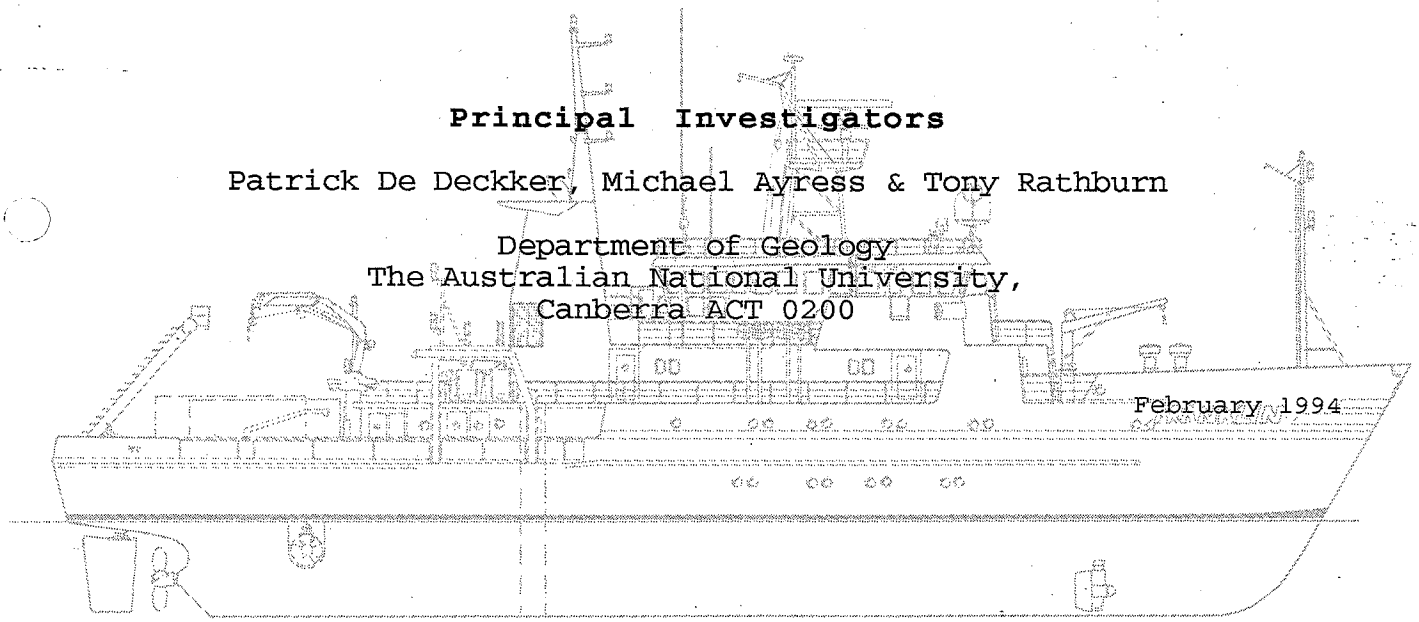
National Facility
Oceanographic Research Vessel

RESEARCH SUMMARY

CRUISE FR 1/94

Sailed	Hobart	2200 Monday 10 January 1994
Arrived	Sydney	1200 Tuesday 18 January 1994

COLLECTION OF PLANKTONIC AND BENTHIC ORGANISMS FOR THE INTERPRETATION OF SEDIMENT CORES NEAR THE SUBTROPICAL CONVERGENCE ADJACENT TO TASMANIA



Principal Investigators

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February 1994

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FRANKLIN

RESEARCH SUMMARY

CRUISE FR1/94

1. ITINERARY

Sailed Hobart 2200 Monday 10 January 1994
Arrived Sydney 1200 Tuesday 18 January 1994

2. SCIENTIFIC PROGRAM

To determine the position of the subtropical convergence in the vicinity of Tasmania during the last glacial/interglacial cycle through the study of deep-sea cores.

To collect samples of plankton and benthos along a north/south transect in the southern portion of the Tasman Sea of relevance for the interpretation of microfossils from deep-sea cores.

To collect water chemistry data for comparison against the chemical composition of microfossils recovered from deep-sea cores.

3. PRINCIPAL INVESTIGATORS

Dr Patrick De Deckker (Chief Scientist)
Dr Michael Ayress, Dr Tony Rathburn

Department of Geology
The Australian National University
Canberra ACT 0200

4. RESULTS

Four 5m long gravity cores were obtained from depths ranging between 1900m and 3177m. Core GC1 was obtained in the northern end of the South Tasman Rise and the other 3 (GC2-4) on the East Tasman Plateau. These cores definitely yield sediments deposited during the upper Quaternary, and which are rich in carbonates. Foraminifers, nannoplankton and diatoms were recovered in all cores. Core GC-1 shows evidence of turbiditic sedimentation, and all other cores appear undisturbed and contain numerous, obvious laminae.

The following analyses on the cores will be done in 1994: extraction of microfossils (benthic and planktic foraminifers, ostracods, nannoplankton, diatoms and pteropods), x-ray mineralogy, sediment and microfossil chemistry, stable-isotope chronology from microfossils, and total carbon analyses

Twenty one surface water samples (10L each) were taken along a north/south transect during the cruise, and an effort was made to cross the subtropical convergence on 2 occasions. These samples were filtered for chemical analyses in Canberra, and for extraction of diatoms and nannoplankton. The recovery of the nannoplankton has been a great success, and there are substantial floral changes. Diatom analyses await examination.

Numerous plankton tows were taken during the cruise at the same locations of the water samples. These await examination. The principal aim of this sampling was to determine the foraminiferal composition at the sea surface along a north/south temperature gradient.

Due to the breakdown of the *Franklin's* bow thruster, and the continuous rough weather conditions, we only obtained one CTD profile, and were prevented from taking box cores at designated localities.

Our box corer did not operate satisfactorily, probably due to its insufficient weight. Numerous attempts were also made at coring other sites on the South Tasman Rise, but we encountered a 'hard ground', probably resulting from bottom erosion.

5. CRUISE NARRATIVE

DAY 1 - JAN 10
Departure from Hobart at 22h00 and we decided to proceed to station 1 (original) where it was our intention to lower a box corer down to a depth of 400m. We decided to take some plankton samples on our way to station 1 in an attempt to trace the influence of water salinity and temperature in zoo and phytoplankton distribution.
We did not arrive at the 1st station until Day 2.

DAY 2 - JAN 11
Arrival at Plankton station now labelled as 1P, and 1PP for *plankton tow*, 1P diat for *diatoms* through filtration and 1P nanno for another filtrate for *nannoplankton*.

The 1st P collection was done very close to the shore. There was a bit of kelp floating, some froth and many fast moving squid. The plankton tow was very rich, with numerous fish eggs(?) and zooplankton. Two pomade jars were obtained.

This station was taken at around 01h 36 and salinity 35‰ and water temp 13.88°C. Water depth 73.5m.
Coord. 43°24.47'S:147°24.18'E.

The second P collection was taken later at ~ 01h40 and once again the shore with a lighthouse were in sight. Salinity remained at 35‰ and temperature was 13.81 °C - 13.87° during sampling.
Coord. 43°29.83'S:147°24.24'E.
The plankton tow was as rich, but this time there was a blue bottle and many blue egg cases (?).

Note that a sample for stable-isotope was taken on each occasion from the buckets in the lab, but we need to know that the water was poured into the bucket on the deck, thus resulting in perhaps water mixing bubbling with the atmospheric oxygen and CO_2.

On all occasions and the procedure is to follow afterwards, a filtered sample (one for cations analysis in a 60 ml bottle that is acidified with 5 drops of HNO_3, conc. - and another for anion analysis in a 125 ml bottle) is taken after the first filtered sample has been taken and a second filter used. This ensures the least contamination.

It was our intention to take a third plankton collection before arriving to our original station 1, but there was a misunderstanding between Tony and the captain, and we did not collect a 3rd sample before arriving for our station 1, which was meant to be at 400 m water depth. We missed the 400 m contour due to problems with the bottom scanner, and we arrived at greater depths (~ 1000 m) very rapidly. We lost a lot of time trying to make the box corer work. On our 4th attempt the box corer reached the surface with a few remains of bryozoans and possibly barnacles on the inside walls of the box core. It appears that the sea floor was sandy there. A previous box core had a lot of sand on the frame too.

We decided to abandon this station which was meant to be station 2, and ignored our earlier station 1.

We took a plankton tow with the ship moving at about 1 knot. The plankton tow was definitely poorer with little material and possibly 1 pteropod. A 10 minute tow was made. The same for the next tow made by S. Nees together with J.J. Pichon & C. Hiramatsu. I did not participate into this last tow and filtering. Plankton collection 3 P occurred at ~ 10:20; Latitude 44°09.78'S and temperature was 14.36°C and salinity 35.5‰.

We left the site for another plankton collection located at 44° 30.4'S where the temperature was 14.75°C and salinity 35.64‰.

I noted a sharp temp. break between 44°37'S:147°00'E and 44° 54'S:146.59°'E. This area may be the location of the subtropical convergence.

In fact the next sample collection for plankton 5P was taken at 45° 00.11'S:146°57.19'E. The water depth there was 3177m.

It is probable that this sample was very rich in filamentous 'algae' - perhaps this richness is linked with the subtropical convergence.

We left this site to go to the next 1/2 degree in latitude further south, to find a sample that appeared rich in zooplankton and 1 small blue bottle. The "fish eggs- butterfly jellyfish' have a blue component inside. There appear to be phytoplankton in this sample too. 5 litres of each of water were filtered by nanno & diatoms. Same procedure as before.

Sampling procedures commenced at 18h36 and lasted for 15 minutes, because due to the high seas, the net was frequently partly out of the water. Unfortunately, part of the mesh inside the bottom box of

the net got damaged, and we may have lost a little bit of the sample. Nevertheless it was still quite rich. Pichon made a slide of the material left of the small net.

We are now heading for 46°00'S where I requested another plankton collection.

7P site. This sample was taken without any problem and 7 was a very rich plankton tow. We filled in 4 pomade jars!

We then proceeded to the first coring site, close to the original station 3.

A box corer was sent down at 23h57 and it returned empty. A Smith-McIntyre type grab sampler went down at 0h52 and returned at 01h27 from a depth of 1,900 m. It came back with sediment. Several bags were taken by Tony Rathburn and Leanne Dansie, and smear slides were made too. Nannoplankton were seen, but not diatoms. One sample of the very surface was taken and put in a separate bag.

DAY 3 JAN 12

A gravity corer (GC-1) was sent down at 07h33 at position 46° 12.10'S:146°29.96'E at a depth on the sounder of 1893 m.

It hit bottom 20 min later and was brought back on deck at 08h43. The core lost a bit of fluid and mud from its top portion when brought on deck through the flap above the bomb. It appears that the core yield full recovery but that a bit was lost from the top of the core during extrusion. Thus, we may be missing the upper ?20cm of the core. There was some sediment left in the barrel which had to be washed.

A CTD profile was taken at this site too and we received a copy of the results on the attached graph. The timing of the CTD profile was 02h43 for start and it reached the bottom at 03h20. Several samples of water were collected for us at 50m and at the bottom, just above the sea floor. I did not filter these 2 water samples for chemical analyses and took also 2 samples for stable-isotopes.

I also filtered about 3.5l each time for a nannoplankton and diatoms from the sample taken at 50m water depth.

At 10h02 a basket sample was taken for standard water analysis and filtrates for diatoms and nanno. A plankton and net tow was also taken. It contained some plankton.

The decision after this was to go to a site at 1750 m and we commenced travelling to a potential site located between station 3 and station 5. As the weather deteriorated, especially with extremely high waves, after arriving to our proposed new coring site, we were told by the captain that it was too dangerous to proceed coring. We waited at this coring site hoping that the low that has to pass over our area is doing it rapidly. It is now 17h 35 and are still waiting!!

The problem continued with the bow thruster which remained unfixed. This finally meant that no more CTD samples could be taken.

After midnight I discussed the situation with the captain who agreed to stop the drifting of the ship and head for the station mentioned above which is between our original station 4 and 5.

DAY 4 - JAN 13

We reached this station and sent the gravity corer down at 46°35'S :146°53.74'E. The water depth was ~1783 m. Unfortunately the corer returned empty. Time of return was approx 01h20.

We decided to head for station 5 instead of attempting to core again because the seas were still rather rough and the captain was unhappy about the dangerous aspect of bringing the corer back onto the ship. We travelled to the original station 5 in the hope that the weather would improve there, thus rendering the core recovery safer.

We arrived at station 5 (1500m) at around 02h15 but water depth was around 1700m, so we decided to go further towards station 6 until we reached 1500m of water depth. We finally reached the plateau after having passed above a small trough.

We arrived at the site at around 03h00 am and were told to wait 2 hours for the seas to become calmer. Apparently, at 0500 Bob Edwards recommended that we wait another hour!

Waves still too strong - hence wait until 07-7h30. We waited until ~ 09h00 to receive permission to drop down the core - the waves were quite high, but unfortunately the core barrel came back empty.

At about 10h00 I took a plankton tow and water samples. Collection 9P - (Coordinates are in both books.)

Another core was sent down at 12h30 - water depth 1583 m. It took a while between the 2 coring exercises because the cable had to be cut off near its end as a result of frequent twisting in the vicinity of the corer. We drifted away from our original station 5.

Coring was unsuccessful, and we came to the opinion that the bottom is hard everywhere in this area. This is a flat plateau that extends a long way where bottom currents must be quite strong.

We headed towards station 6 which is ~1,250 m deep and tried our luck there. This would take approx 2h of travelling-time.

We tried a core at 1,235 m and the barrel came back empty. [What a disappointment!] We took a plankton sample and associated water sample for nanno/diatoms etc.

It is now 17h00 and we are heading off to station 7.
21h20 The weather continues to be rough with winds up to 24 knots. So the captain has recommended no coring. We are drifting above station 7 going now and again between 920 and 1000 m water depth. A high should be coming tomorrow! Let's hope.

DAY 5 - JAN 14

We spent the whole night waiting for weather improvement but no luck. At 8h30 we decided to wait for a weather map to arrive before making a final decision. There was a high coming towards us and the barometer was showing an increase in pressure 1004 mb.

I decided to wait until 14h00 in consultation with the others in the hope that the weather would improve so as to allow coring. It was a frustrating time. But then, close to noon, after seeing the prognosis of the weather and the weather map of that morning, I realized that we had little chance of seeing wave swells decreasing in size. Our position at the time was 47°12'S:147°20'E at 11h45, so we turned around towards the East Tasman Plateau in the hope that by the time we would reach it, the atmospheric high would have reached the site. After consulting with the others, we decided to attempt coring 3 different sites along a transect going from ~ 3000 m, 2,500 and ~ 1500 m water depth.

We also decided to take plankton samples + water samples etc.every 3 hours on our way to the coring station.

At station P11 the boat could not slow down enough to permit plankton towing, but unfortunately I was unaware of this, so when I retrieved the plankton net, it was badly torn in several places. I have attempted to repair this but am unwilling to put the net again in the water unless we are travelling at a speed of 1 knot. At P12 we took the standard water samples for chemical and diatoms/nanno analyses.

We headed NE towards the East Tasman Plateau and decided to take water and diatom and nanno samples every 3h. This continued overnight. At 22h00 I put the net back in the water for a short time, but it got damaged again. I carried out a repair on the net by shortening it once more.

DAY 6 - JAN 15

Travel continued during the night, and we reached the next coring station (deepest ~ 3000 m) round 07h00. The core (GC-2) was brought back close to 09h00 and we obtained a 4.5 m recovery. The top of the core was orangey brown and the sediment at the cut sections (every 1 m) was firm. We attempted a box core then but it failed. It returned to the surface empty - and still open. One of the top bars holding the corer got damaged, suggesting that it may have either tipped over or got tangled in by the cable. At 11h00 after that I took a plankton tow and it proved successful although the net contents were rather poor. A diatom/nanno/water sample was taken earlier and it appeared that algae were seen when washing the filter paper with alcohol. We then headed towards the next coring station. The speed of the vessel was incorrectly recorded on the screen as we were going at a speed of 12 knots and the display said 2 knots.

We took another core GC-3 further north, and once again were successful at recovering a 4.80 m long core. We did not try a box corer nor a CTD because of the shortage of time. A plankton tow was taken at that locality. We went further north in order to take a core on the top of the East Tasman Plateau - water depth was 913 m. We waited to be above a flat plateau before coring. This we eventually did, but the recovery was nil. We only obtained gravel and a few gastropods at the entrance of the barrel in the diaphragm. The gravel may be made of basalt or a ferruginous concretions. Obviously, this area must undergo the influence of strong currents.

We took a plankton tow above this site, and we returned to a rich sample, like at the beginning of the trip.

We headed further north, and this was to become our last coring station. It will be approx. midnight upon arrival at the site. The water depth there should be 2650 m.

The coring was a success, as we recovered 4 m of sediments. The top was soft and partly runny. We took a plankton sample and water samples near that site (while coring).

DAY 7 - JAN 16
I decided to take a sample of water + plankton every 6 h from then on but it was already 11h30 and the sea was too rough to collect such samples. So this exercise was kept on hold.

No more samples were taken during that day because of the very rough seas caused by the poor weather. It would have been too dangerous to filter water in the lab at the back of the ship!! Someone could have been hurt due to the frequent and rough bouncing of the ship. That evening I decided to cancel any further water sampling and the instruments were stored in boxes in the operation room so as to prevent their damage due to the rocking of the vessel. This prevented us from taking any further samples. The weather was still of a poor condition by midnight.

DAY 8 - JAN 17
The seas were calmer and we spent the day cleaning the lab, packing all the gear, taking everything out of the operation room and dismantling the gravity corer. We then had to wait before reaching Sydney at noon DAY 9 - JAN 18.

DAY 9 - JAN 18.
Arrival in Sydney at noon - unloading of gear on deck and return to Canberra.

6. OVERALL IMPRESSION OF THE CRUISE

Overall, a profitable cruise with sufficient core material to work on. Disappointing also with the bad weather which prevented us from coring the southern end of the South Tasman Rise, obtaining CTD profiles (because of the breakdown of the bow thruster) and having a box corer which didn't function properly.

7. SCIENTIFIC PERSONEL

At scientists all are based at the Department of Geology at ANU, but in brackets the various institutions of origin of these people are listed.

Patrick De Deckker		Chief Scientist
Michael Ayress		
Tim Barrows		
Leanne Dansie		
Chikara Hiramatsu	(JAPEX exploration, Chiba, Japan)	
Jean Jacques Pichon	(Univ. Bordeaux I, France)	
Stefan Nees	(Kiel University, Germany)	
Tony Rathburn		

Bob Edwards	CSIRO - ORV	Cruise Manager
Heaney Bernadette	"	
Erik Madsen	"	
Mark Rayner	"	

8. ADDITIONAL COMMENTS

We are extremely grateful to Bob Edwards, Cruise Manager, for his help and constant advice during the cruise, and during its preparation. We also found the Master, Neil Cheshire and all members of his crew most obliging and of great help during the coring operations.

9. APPENDIX

This contains a complete list of the sampling stations, including, plankton tows, water samples,gravity cores, McIntyre samples and (failed) box core stations.

Update: Feb 16 1994 ***The Australian Marine Quaternary Program***

RV FRANKLIN-cruise FR 1/1994 Jan. 10 - 18 1994, Hobart - Sydney

sample-labels: FR1-94-##P (nanno/dia) means plankton samples (buckets and net-tows)
sample-labels: FR1-94-ST##(b/g/gr) means sediment-samples (corers, grabs?)
("ST" = station)

Stationlist REPORT DATA AND EVERY SAMPLE TAKEN IN THE LOGBOOKS !!!!

#	"station" FR1-94- ...	date	time (*)	lat. (° S)	long. (° E)	watrd. (m **)	surface sal. (‰)	surface temp. (°)	gear	pntr. (m)	rcvy. (m)	samples taken and remarks
1	-1P	11.1.	1:36	43°29,97	147°24,18	surf.	35	13.88	bu			d18O, diat. & nanno filter + res., 2 waters.
2	-1Pp		1:40-1:50	43°29,83	147°24,24	surf.	35	13.87	pn			2 pomade jars with alcohol
3	-2Pp		3:37-3:48	43°44,95	147°18,66	surf.	35.16	13.09	pn			2 pomade jars with alcohol
4	-2P		3:42	43°44,95	147°18,54	surf.	35.14	13.09	bu			d18O, diat. & nanno filter + res., 2 waters.
5	-ST1b/1		7:09	44°07,72	147°13,21	1097	35.5	14.38	b	-	-	empty box
6	-ST1b/2		7:56	44°08,78	147°14,22	1137	35.51	14.38	b	-	-	empty box
6	-ST1b/3		8:47	44°09,77	147°15,30	1196	35.51	14.38	b	-	-	empty box
7	-ST1b/4		9:59	44°09,09	147°15,96	1182	35.53	14.38	b	-	-	empty box
8	-3Pp		10:30-10:40	44°09,72	147°15,09	surf.	35.5	14.36	pn			2 pomade jars with alcohol
9	-3P		10:35	44°09,74	147°15,21	surf.	35.5	14.36	bu			d18O, diat. & nanno filter + res., 2 waters.
10	-4Pp		12:44-12:54	44°30,04	147°08,04	surf.	35.64	14.75	pn			1 pomade jar with alcohol
11	-4P		12:49	44°30,12	147°08,13	surf.	35.64	14.75	bu			d18O, diat. & nanno filter + res., 2 waters.
12	-5Pp		15:42-15:54	45°00,11	146°57,19	surf.	35.35	13.31	pn			1 pomade jar with alcohol (very rich)
13	-5P		15:44	45°00,45	146°57,13	surf.	35.36	13.3	bu			d18O, diat. & nanno filter + res., 2 waters.
14	-6Pp		18:36-18:54	45°30,12	146°46,48	surf.	35.22	13.25	pn			1 pomade jar with alcohol
	-6P		18:38	45°30,09	146°46,5?	surf.	35.22	13.25	bu			d18O, diat. & nanno filter + res., 2 waters.
	-7Pp		21:43-21:52	46°00,13	146°34,61	surf.	35.28	13.1	pn			4 pomade jars with alcohol
17	-7P		21:45	46°00,13	146°34,61	surf.	35.21	13.21	bu			d18O, diat. & nanno filter + res., 2 waters.
18	-ST2b/1		23:57	46°14,12	146°30,65	1880	34.92	11.79	b	-	-	empty box
19	-ST2gr/1	12.1.	1:27	46°15,08	146°32,49	1900	34.94	11.58	gr	surface		var. samples taken (see logbook)
20	-CTD-1		3:20	46°14,30	146°31,14	1946	34.79	12.31	CTD			var. samples taken for nanno and chem. analy. (see log
21	-ST2gc/1 (=GC1)		8:03	46°12,14	146°29,68	1893	34.81	11.4	gc	5 m ?	4.75	gc cut into 5 1 m sections (=GC1)
22	-8P		10:02	46°12,81	146°29,80	surf.	34.83	11.4	bu			d18O, diat. & nanno filter + res., 2 waters.
23	-8Pp		10:01-10:11	46°12,81	146°29,80	surf.	34.83	11.4	pn			4 pomade jars with alcohol
24	-ST3gc/1	13.1.	00:42	46°36,22	146°54,14	1763	35.21	12.45	gc	-	-	barrel empty
25	-ST53gc/1		9:41	46°45,21	147°04,40	1531	35.39	12.82	gc	-	-	barrel empty
26	-9P		10:53	46°44,79	147°03,32	surf.	35.31	12.67	bu			d18O, diat. & nanno filter + res., 2 waters.
27	-9Pp		10:51-11:01	46°44,79	147°03,32	surf.	35.31	12.67	pn			pomade jars with alcohol
28	-ST4gc/1		12:54	46°43,90	147°02,16	1585	35.47	13.26	gc	-	-	barrel empty
29	-10P		16:47	46°56,55	147°22,42	surf.	35.17	11.82	bu			d18O, diat. & nanno filter + res., 2 waters.
30	-10Pp		16:45-16:55	46°56,55	147°22,42	surf.	35.17	11.82	pn			pomade jars with alcohol
31	-11P	14.1.	13:07	46°59,99	147°33,??	surf.	34.2	10.38	bu			d18O, diat. & nanno filter + res., 2 waters.
32	-11Pp		13:05-13:20	46°59,79	147°31,53	surf.	34.21	10.2	pn			pomade jars with alcohol
33	-12P		16:20	46°36,04	147°57,51	surf.	34.74	11.83	bu			d18O, diat. & nanno filter + res., 2 waters.
34	-13P		19:05	46°13,40	148°20,07	surf.	34.49	11.09	bu			d18O, diat. & nanno filter + res., 2 waters.
35	-14P		22:09-22:14	46°49,44	148°44,72	surf.	34.63	12.15	bu			d18O, diat. & nanno filter + res., 2 waters.
36	-14Pp		22:01	46°49,62	148°44,01	surf.	34.66	12.13	pn			pomade jars with alcohol (net broken)
37	-15P	15.1.	1:01	45°25,20	149°08,82	surf.	34.62	12.17	bu			d18O, diat. & nanno filter + res., 2 waters.
38	-16P		4:06	45°00,71	149°36,80	surf.	35.03	13.63	bu			d18O, diat. & nanno filter + res., 2 waters.
39	-ST5gc/1 (=GC2)		7:58	44°35,94	149°55,69	3053	35.06	13.56	gc	4,5 ?	4.65	gc cut into 5 1 m sections (=GC2)
	-17P		10:17	44°38,31	149°53,21	surf.	35.04	13.53	bu			d18O, diat. & nanno filter + res., 2 waters.
	-ST5b/1		10:42	44°38,67	149°52,89	3067	35.04	13.53	b			empty box
42	-17Pp		11:51	44°39,77	149°51,93	surf.	35.06	13.58	pn			pomade jars with alcohol (net broken)
43	-ST6gc/1 (=GC3)		15:21	44°15,38	149°59,47	2667	35.08	14.21	gc	5 ?	4.71	gc cut into 5 1 m sections (=GC3)
44	-18P		14:53	44°15,20	149°59,67	surf.	35.08	14.21	bu			d18O, diat. & nanno filter + res., 2 waters.
45	-18Pp		14:37	44°16,83	149°58,81	surf.	35.08	14.35	pn			pomade jars with alcohol (net broken)
46	-ST7gc/1		19:37	44°01,37	150°27,01	913	35.01	14.04	gc	-	-	hit hardground, some pebbles and shells only
47	-19P		19:39	44°01,37	150°27,01	surf.	35.01	14.04	bu			d18O, diat. & nanno filter + res., 2 waters.
48	-20P		20:08	44°01,60	150°26,00	surf.	35.02	13.93	bu			d18O, diat. & nanno filter + res., 2 waters.
49	-20Pp		20:05	44°01,60	150°26,00	surf.	35.02	13.93	pn			pomade jars with alcohol (net broken)
50	-21P		23:07	43°30,94	149°46,72	surf.	35.04	13.72	bu			d18O, diat. & nanno filter + res., 2 waters.
51	-21Pp		23:54	43°30,36	149°46,65	surf.	35.01	13.68	pn			pomade jars with alcohol (net broken)
52	-ST8gc/1 (=GC 4)	16.1.	00:30	43°30,52	149°46,59	2933	35.02	13.7	gc	4.5 ?	3.92	gc cut into 4 1 m sections (=GC4)

Abbrevations:

(*) - time is local time (bottom time, or towed from->to)
(**) - depth is sounder depth (see monitor)
b - box corer
bu - bucket sample
gc - gravity corer
gr - grab sampler
P - plankton
pn - plankton net
m - meter
surf. - surface
nanno - Nannoplakton (in alcohol)
dia - Diatoms (in formalin)
pntr. - penetration
rcvy. - recovery
watrd. - waterdepth of sample

Franklin cruise 1/94