R.V. FRANKLIN

NATIONAL FACILITY
OCEANOGRAPHIC RESEARCH VESSEL

RESEARCH SUMMARY

R.V. 'FRANKLIN'

FR08/88

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Principal Investigators:

Dr. I. McDougall
Research School of Earth Sciences
The Australian National University

Professor D.H. Green
Department of Geology
University of Tasmania

For further information contact

ORV Operations Manager
c/- CSIRO Division of Oceanography
GPO Box 1538, Hobart, Tas. 7001
Telephone (002) 20 6222
Telex AA 57182

AUSTRALIA

R.V. FRANKLIN IS OWNED AND OPERATED BY CSIRO

CRUISE SUMMARY
R.V. FRANKLIN
FR08/88

ITINERARY

Depart Townsville	1000 hours, Thursday 6 October, 1988
Arrive Sydney	1600 hours, Monday 17 October, 1988

SCIENTIFIC PROGRAMME

The main aim of this cruise was to dredge volcanic rock samples from selected seamounts of the Lord Howe and Tasmantid Seamount chains in the Tasman Sea. These samples were intended to provide the basis for geochronological, geochemical and petrological studies of the seamounts to further elucidate the evolution and origin of these two parallel seamount chains that each extend in a north-south direction for more than 1000 km.

PRINCIPAL INVESTIGATORS

Dr I. McDougall,	Research School of Earth Sciences, The Australian National University
Professor D.H. Green,	Department of Geology, University of Tasmania

RESULTS

Overall the results were disappointing as the main objective of the cruise to recover fresh or even relatively fresh samples of volcanic rock from the seamounts, was not achieved.

The most positive result was that weathered basalts were dredged from Nova Bank and Gifford Guyot of the Lord Howe Seamout chain, confirming predictions that these large seamounts are indeed volcanic edifices. Weathered basalt also was recovered in two dredge hauls on Moreton Seamount in the Tasmantid chain.

In addition, limestone was obtained in a number of dredge hauls, and it is hoped that these rocks will be studied by appropriate scientists. Shell debris also was recovered in several hauls; this material is to be forwarded to specialists in the Australian Museum, Sydney.

The limited results obtained arose because of a number of factors, of which two are paramount. First, it had been clearly recognized in the cruise proposal that the dredging of the flanks of these seamounts is difficult, and likely to be especially difficult from those of the Lord Howe Seamount chain, because of the possibility of significant sediment cover. Second, the lack of dredging power meant that we had to be extremely cautious at all times. This lack of power was because the tension at the dredge was generally limited to ~3 tonnes by the weaklinks installed between the wire and the dredge. Despite great care, four dredges were lost. Any snagging of the dredge to the bottom had to be taken seriously and a recovery strategy immediately implemented, often requiring turning of the ship through 180 degrees. The lack of dredging power was demonstrated clearly by the fact that virtually all samples

recovered were relatively soft sediment or weathered basalt, or clasts that could readily be swept up by the dredge. Dredging power was insufficient to break off hard rocks such as fresh basalt or indurated limestone. We believe that this was the major factor in our inability to augment the collection of relatively fresh basalt from the Tasmantid Seamounts made during two earlier **Franklin** cruises (FR03/85, FR07/86), when the weaklinks used (0.6 tonne SWL shackles) must have allowed significantly higher loads.

The lack of recovery of hard rock from Moreton, Queensland, Britannia, Derwent Hunter and Barcoo Seamounts, loss of another dredge on Derwent Hunter, together with having only one remaining weaklink assembly, and the need to re-use previously stressed brass rod weaklinks, resulted in a decision to abandon further dredging attempts about 1.5 days earlier than scheduled.

Summary of Dredging Results

Nova Bank: 3 dredge attempts

D1 - Broken weaklink, but coarse, friable limestone trapped in bag
D2 - Small weathered basalt fragments
D3 - Small amount of Mn crust

Argo Bank: Single dredge attempt

D4 - Soft sandy limestone

Capel Bank: 3 dredge attempts

D5 - No recovery
D6 - Ooze in pipe dredge of Lister dredge
D7 - Lister dredge lost

Gifford Guyot: 5 dredge attempts

D8 - Soft, muddy limestone
D9 - Large block of weathered, Mn-crusted basalt
D10 - No recovery (minor pumice)
D11 - No recovery
D12 - Weaklink broke, dredge recovered backwards

Moreton Seamount: 3 dredge attempts

D13 - Small amount of amygdaloidal, weathered basalt, together with calcareous material
D14 - Large weathered basalt block
D15 - Minor coral debris

Queensland Seamount: 4 dredge attempts

D16 - No recovery except for minor pumice
D17 - Weaklink broke, dredge recovered backwards
D18 - Lost dredge (steel ring at bottom of chain bag parted as recovery chain actuated)

D19 - Lost dredge (recovery chain pulled out of chain bag)

Britannia Seamount: 6 dredge attempts made

D20 - Weaklink sheared, dredge recovered backwards

D21 - Weaklink sheared, dredge recovered backwards

D22 - Snagged dredge, eventually recovered intact, minor Mn crust

D23 - Small limestone clasts

D24 - Small limestone clasts and modern shell material

D25 - Aborted as wire angle excessive

Derwent Hunter Seamount: One dredge attempt

D26 - Dredge lost; rear of NZ dredge pulled out by recovery chain

Barcoo Seamount: 3 dredge attempts

D27 - Weaklink sheared, dredge recovered backwards

D28 - Weaklink sheared, dredge recovered backwards

D29 - Weaklink sheared, dredge recovered backwards

CRUISE NARRATIVE

R.V. **Franklin** sailed from Townsville at 1000 hours (EST) on Thursday 6 October, 1988, heading for Nova Bank, 570 nautical miles (1055 km) north of Lord Howe Island. The transit time of 63 hours to Nova Bank was in delightfully warm, sunny conditions during the daylight hours, with calm seas prevailing. Passage was inside the Barrier Reef to Swains Reefs, then essentially due east to Nova Bank. During this 2.6-day passage, the six dredges on board were checked out and netting bags installed inside the chain bags. The dredges available consisted of 3 Lamont-style box dredges with chain bags, supplied by the University of Tasmania, one large Lister-type dredge (ANU) and two New Zealand box dredges with mesh wire cages, modified by the addition of large steel masses to the sides of the dredges, supplied by ANU. In addition, during the passage, members of the scientific crew studied BMR sparker records available for a number of the seamounts.

So it was with considerable optimism that the first dredge site was chosen on the relatively steep western flank of Nova Bank, which rises from depths of more than 2000 m to a nearly flat-topped summit at a depth of about 300 m. The first dredge attempt commenced at 0530 hours (EST) on Sunday 9 October. The wire-out meter and the tensiometer readout to a chart recorder both were operational, although the tensiometer readings were only relative. As a hint of things to come, the main weaklink failed during dredging, but the dredge was retrieved by the back chain, together with some sandy limestone fortuitously caught up in the net bag. The next dredge (D2), later in the day, at a locality some 11 nautical miles south on the steep western flank of Nova Bank, produced a few small weathered clasts of basalt from a depth of ~1250 m, providing us with evidence that indeed these large seamounts of the Lord Howe chain were constructed by basaltic volcanism.

Organisation of the scientific crew into two 12-hour watches (0100-1300 hours, 1300-

0100 hours) ensured that dredging operations could be continued on a round-the-clock basis. This worked well, but when there were closely spaced dredging operations throughout a watch there was a problem of fatigue setting in. A single dredge typically took about two hours, usually ~30 minutes to get the dredge to the appropriate depth (2000-1000 m), then commonly 30 to 50 minutes of slow dredging upslope with the ship to obtain the first bite, hopefully followed by several additional bites before proceeding to wind the dredge in carefully. Hangups at this stage were common, and breaking of one or both of the weaklinks occurred all too frequently, despite taking the utmost care with winching and handling of the ship.

Following the dredging on Nova Bank (Sunday 9 October), one site was dredged on Argo Bank, just to the south, recovering a sandy limestone from ~1200 m. Late in the evening of 9 October, we steamed to Capel Bank, still in good weather conditions. Most of Monday 10 October (EST) was spent on carrying out three dredgings on the large Capel Bank structure (60 nautical miles long, 30 nautical miles wide, rising from a depth of ~2000 m to a flat broad summit at ~60 m). The only recovery of material was deepsea ooze at about 1200 m. The third dredge attempt resulted in the loss of the large Lister dredge following a hookup at about 700 m, a great disappointment to all on board.

Late on Monday 10 October, following loss of the Lister dredge, we set course for Gifford Guyot, a smaller edifice rising to within about 300 m of sea level. Some 20 hours of Tuesday 11 October were spent dredging at five sites on the northern and southern seamounts that comprise Gifford Guyot. The most significant sample recovered was a large Mn encrusted, weathered basalt block about 40 x15 x15 cm, confirming the volcanic origin for these seamounts.

Somewhat disappointed at our inability to recover fresh basalts in the Lord Howe Seamounts, the decision was taken to head for Moreton Seamount in the Tasmantid chain. This 21-hour passage took place from late evening Tuesday 11 October (EST) in good sea conditions. Moreton is a seamount that is conical in form and probably did not reach sea level when it was an active volcano. Our survey showed that the summit area is at least as shallow as 630 m, more than 100 m shallower than previously reported. Of the three dredge hauls over a six hour period on Moreton, two provided basalt, altered unfortunately.

Early morning of Thursday 13 October, we began to steam south to Queensland Guyot, arriving mid-afternoon. Dredging was done at nine sites over the next 35 hours (until midnight 14 October) on the very large Queensland-Brittania volcanic structure that extends over about 100 nautical miles, is 30 miles wide and rises from a depth exceeding 4500 m to a bevelled summit at a depth of about 380 m. This dredging in relatively calm conditions, but with currents up to 1 knot, was disastrous, with many many hangups, two lost dredges, and several dredges recovered backwards. There were two small limestone fragments recovered, but no volcanic material at all. On previous cruises we had made two successful dredges of fresh basalt from this large structure.

A potential attempt to dredge Stradbroke Seamont was prevented by the onset of strong northwesterly winds early on Saturday morning 15 October. The ship hove to for some hours, but as it appeared unlikely that the weather would improve for at least 12 hours, we decided to head south to Derwent Hunter. Owing to difficulties experienced in dredging basalt from the Lord Howe Seamounts, it was also decided not to attempt dredging of the Elizabeth Reef

structure. It was felt that the extra time could best be used undertaking dredging of the Tasmantid Seamounts.

The 7.5 hour passage to Derwent Hunter was done from mid-morning Saturday 15 October as a cold front moved through the region, with winds up to 30 knots. Moderating conditions with the southerly change allowed a dredge attempt on the northern end of Derwent Hunter on the Saturday evening. Two seemingly small bites were obtained with the dredge and it was hauled in. To our surprise, no dredge came back with the wire, yet the tensiometer indicated maximum tensions well below that at which failure had previously occurred. A deformed portion of the rear frame of the New Zealand-type dredge was returned with the recovery chain.

As we were now reduced to but one operational dredge, with the other N.Z. dredge needing major repairs, we headed south to Barcoo Seamount, an important target for the cruise. This 13 hour passage in somewhat lumpy seas allowed us to commence dredging Barcoo Seamount at 0900 (EST) on Sunday 16th October. Three successive dredge attempts over the next six hours each resulted in a hookup, failure of the main weaklink, and recovery of the dredge backwards. The tensiometer recordings suggested that failure was occurring at lower tensions than previously, presumably a consequence of having to re-use brass rod weaklinks (4.8 mm diameter) from previous dredge attempts, owing to lack of supplies on the ship. In view of the continuing inability to dredge successfully, because of weaklink failure, the decision was finally taken on Sunday 16th October at 1500 hours to head for Sydney.

On-route from Stradbroke Seamount to Sydney via Derwent Hunter and Barcoo Seamounts, 23 XBT's were launched and the data sent to NAS NOWRA using the IMARSAT Telex. The data was encoded into the standard Bathymessage format. Then data was sent in three seperate transmissions.

Time use

Time spent in passage	177 hours (7.4 days)
Time lost owing to weather	4 hours (0.2 days)
Time spent site surveying and dredging	88 hours (3.7 days)
TOTAL	11.3 days

SUMMARY

The cruise produced some positive results. These included recovery of basalt, albeit weathered, from Nova Bank and Gifford Guyot in the Lord Howe Seamount chain, and weathered basalt from Moreton Seamount in the Tasmantids, as well as a number of sediment samples. Twenty nine dredge attempts were made, of which 13 recovered rock samples, 5 arrived back at the surface empty, 7 returned empty dredges by the back recovery safety chain, and 4 dredges were lost.

Despite the modest successes, the main aim of the cruise, to obtain fresh basalt samples from the Lord Howe and Tasmantid Seamount chains was not achieved. In our opinion, the main reason for this disappointing and frustrating result was that the dredging power of the R.V. FRANKLIN has been reduced considerably compared with earlier successful cruises

(FR3/85, FR7/86) through the installation of weaklinks (between the towing wire and the dredge) that fail at substantially lower loads than previously. The weaklinks used were generally rated to fail at 2.9 or 3.2 tonnes. Our experience shows that these limits normally allow only dredging of soft sediment or broken and weathered hard rock, such as might be found in a submarine talus slope. The breaking (and sampling) of rock from solid outcrops of basalt or indurated sedimentary rock (e.g. limestone) seems to be nearly impossible with the weaklinks utilized during this cruise.

We understand the need to protect the main towing wire and associated equipment, especially the A-frame and winch, from excessive loads. If further geological studies involving dredging of hard rocks are to be undertaken with the R.V. **Franklin**, consideration will need to be given to either allowing the loads on the existing wire to be increased to nearer the 8.5 tonne minimum breaking load specification for that wire, or to install a stronger wire that permits the 8 tonne safe working load of the A-frame to be utilized. (For comparative purposes, the Scripps Institution of Oceanography use for dredging purposes a 14 mm wire rated at ~14 tonnes 85% yield strength, apparently without weaklinks).

Four of the scientific crew for this cruise have been involved in more than 12 oceanographic cruises during which successful dredging of fresh volcanic rocks was undertaken, so that there was a good deal of experience to draw upon for the dredging.

The entire crew of the R.V. **Franklin** were most helpful throughout the cruise. We particularly wish to thank the deck officers for their ship handling during the dredging operations. and the ship's engineers for working long and hard to repair and rebuild damaged dredges. The Cruise Manager (David Vaudrey) and Phillip Adams, both from CSIRO, took an active role in our dredging operations and were very helpful in all aspects of the cruise.

EQUIPMENT REPORT

1. 150 m of 12mm wire rope was cut from the towing wire. 100m after D8 at Gifford Gyot and a further 50m was cut at the completion of the voyage.
2. The power supply for the RD51 disk for Micro2 failed, due to a short circuit, with some corruption to the disk evident (unable to read/write certain files). A spare was installed and after the required directories where created logging was recommenced.
3. Weaklinks: A total of 2 complete weaklink assemblies and a further 2 male halves were lost. Only one complete link survived.

PERSONNEL

Dr. I. McDougall	RSES, Australian National University (Chief Scientist).
Dr. A.J. Crawford	Dept. of Geology, University of Tasmania.
Mr. S.M. Eggins	Dept. of Geology, University of Tasmania.
Dr. T.J. Falloon	Dept. of Geology, University of Tasmania.
Mr. D.B. Patterson	RSES, Australian National University.
Dr. J. D. Woodhead	RSES, Australian National University.
Mr. D. Vaudrey	CSIRO ORV Core Staff (Cruise Manager).
Mr. P. Adams	CSIRO ORV Core Staff.

D. Vaudrey
CSIRO Cruise Manager
for and on behalf of
I. McDougall
Chief Scientist
Fr08/88