



National Facility Research Vessel

RV FRANKLIN

VOYAGE DOCUMENTS

RV SOUTHERN SURVEYOR

CSIRO AUSTRALIA

CSIRO MARINE AND
ATMOSPHERIC RESEARCH

Voyage Plans and Summaries

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Franklin Voyage Plan No. FR03/00

Title

Microbes from Hydrothermal Vents: Applications in Mining and Mineral Processing.

Itinerary

Depart Cairns 0800 hrs, Friday 14 April 2000
Arrive Rabaul 1000 hrs, Thursday 4 May 2000

Principal Investigator(s)

Dr Ramond A Binns (Chief Scientist)
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Scientific Objectives

1. The principal aim is to collect samples from actively-forming seafloor hydrothermal deposits in the eastern Manus Basin, PNG, from which microbes will be extracted and cultured for use in a new CSIRO multidivisional research initiative "Biological Applications in Mining and Mineral Processing". Dr Franzmann leads this activity.
2. A second objective is to deploy and test several deep-submergence geophysical sensors being developed in CSIRO to facilitate future seafloor mineral exploration and mining. This is led by Dr Dekker.
3. Finally, geological investigations arising from results of the PACMANUS cruises (1991-97) will be conducted (led by Dr Binns), including
 - Surveys of two sites where there are strong indications of as-yet undiscovered hydrothermal fields
 - A repeat survey of the exceptionally intense SuSu Knolls hydrothermal plume to delineate changes since 1993-1997 measurements
 - Further collections of diffusely vented fluids using the VUNL (constructed for FR-09/97) at the Snowcap, North Su and South Su sites
 - Photography of proposed ODP drill sites
 - CTD -transmissometer surveys to test for possible hydrothermal activity near faults within sediment-filled grabens in St Georges Channel (en route from Cairns, if there have been no delays in transit)

These objectives are listed essentially in order of priority, although we will be attempting to achieve them all, with roughly equivalent time assigned to each if everything goes to plan. Many planned operations will serve several objectives.

Cruise Objectives

Microbiological collections

With *Franklin* positioned over known hydrothermal sites at PACMANUS, DESMOS, and SuSu Knolls (Fig. 1), rock, sulfide and sediment samples will be collected by

- Chain-bag dredge
- Smith-McIntyre grab
- Small gravity corer

All samples are to be brought on board as quickly as possible. After they have been examined and sub-sampled by microbiologists, they will be studied and sub-sampled by the geologists (on deck and in the container lab). Most samples will be preserved by freezing. No extensive culturing is proposed on

board.

In addition, the microbiologists will take subsamples of fluids collected by VUNL (vent funnel, deployed on CTD cable) from above vent fields, and also samples collected within bouyant hydrothermal plumes using the CTD-rosette/transmissometer. These will be processed and chemically analysed in the wet lab and chemistry lab.

Finally it is planned that lines or nets, to which will be affixed many small metal or ceramic plates for collecting microbes, will be laid within the vent fields using moorings, floats and an acoustic release. These will be released for return to surface a day or two later, and the plates preserved for study ashore. Geological or geophysical surveys will not be possible at a site while these collectors are in place.

Geophysical Surveys

The following instruments will be deployed, either on the main towing cable or the hydrowire

- Geochirp acoustic sub-bottom profiler
- Caesium-vapour magnetic gradiometer
- Fluxgate magnetometer which, together with a towed electrode array, will allow induced polarisation (IP), resistivity and impedance measurements

These instruments will be either mounted on (profiler) or towed behind (gradiometer and magnetometer) the geological camera-video sled, which will also contain a video camera, floodlight, batteries, and a data acquisition package. Using appropriate flotation, the gradiometer will tow higher than the camera cage, and the magnetometer at an intermediate height. Length of the tethers is yet to be decided, probably about 20 metres. Total weight of the system (in air) is about 300kg.

The surveys will consist of slow (0.5-1 knot) tows along straight lines located to cross known chimney fields. Simultaneous bottom photography will occur, using a 12kHz pinger on the sled and the ships echosounder (broad beam transducer) to maintain flying height of 3 to 5 metres for the camera.

Initially, the instruments will record their data at the acquisition unit on the camera sled. Then we propose experiments where a fine optical fibre cable (~2mm diameter) will be clipped to the main towing cable as it descends, allowing real-time data transmission to the ship. Conduct of this operation, and indeed the overall method of deploying the geophysical instrument package with its tethered sensors, will require careful planning. Calm conditions will be required.

Geological Investigations

These will use similar methods as for the PACMANUS-III and IV cruises (FR-10/96; FR 09/97)

- CTD-Hydrocasts with transmissometer attached, for plume detection. Real-time display including transmissometer signal will dictate depths of water sampling. Both single dips, and "tow-yo's" will be conducted. For some dips, our own CTD/transmissometer package (self-recording) will also be attached to the rosette for cross-calibration.
- Precision dredging using main towing cable, with DGPS navigation
- Precision deployments of Smith-McIntyre Grab from hydrowire
- Deployments of our small (2m) gravity corer off the main cable
- Bottom-tow video traverses. Our old camera-video sled will be fitted with a new, smaller video system, a height-control pinger, and our recording CTD-transmissometer. Tows to be conducted at 0.5 knot using the "hover" technique under DGPS navigation.
- Deployments of the VUNL (off CTD cable) at diffuse vent sites to collect hydrothermal fluids. The "pogo" technique developed during FR-09/97 will be used again. With a pinger altimeter, and using the tensiometer, the VUNL will be placed gently on bottom and held there for up to 15 minutes while watching for a temperature anomaly. If there is no anomaly the VUNL will be lifted a few metres and re-deployed to bottom, until there is an anomaly. The attached Niskin will then be closed by acoustic release to collect a fluid sample.

Cruise Track

The route from Cairns will be across the Coral Sea to Jomard Entrance, then across the Solomon Sea to St Georges Channel (Fig. 2).

The main area of operations is in the eastern Manus Basin, around and between the PACMANUS site (centred on 03°44'S 151°40'E) and the SuSu Knolls site (03°49'S 152°08'E (Fig. 1).

If there are no delays in this transit, one or more single-dip CTD-transmissometer deployments will be conducted in St Georges Channel before proceeding past Rabaul into the Bismarck Sea. The first of these sites is at 05° 15'S 152°30'E. The intention is to test for hydrothermal activity near transfer faults bounding several sediment basins along the Channel, for future planning purposes. The final operations will be planned for sites close to Rabaul.

Time Estimates

Transit, Cairns to Eastern Manus Basin,	4 days
Operations at PACMANUS and SuSu Knolls,	16 days
Contingency, or operations in St. Georges Channel	1 day
Transit, Eastern Manus to Rabaul	4 hours

Piggy-back Projects

Dr Keith Sainsbury (CSIRO Marine Research, Hobart) has requested that we attempt one or more beam trawls to collect near-bottom biota from close to hydrothermal sites.

Franklin Equipment

All winches, deck crane, laboratories, deck machinery, Differential GPS (essential, with no "spikes" or the ability to filter these out), echosounder, CTD-transmissometer, Niskins, computers, pingers and broad beam receiver, submersible data logger, acoustic release systems, Smith-McIntyre grab, TrackPlot software.

User Equipment

Dredges and depressor weights, small gravity corer, possibly a box corer. Deep tow video system and related equipment including sled. Geochirp acoustic sub-bottom profiler, Cs vapour gradiometer, fluxgate magnetometer. Sealite batteries. Recording CTD-transmissometer. Microscopes, PCs. Vent fluid funnel (VUNL), and equipment for filtering and analysing hydrocast and vent fluid samples. Apparatus for collecting and preserving microbial samples.

Special Requests

We have asked that our equipment, and most of our rock samples remain on board after Rabaul, during the following cruise (FR04/00), for offloading in Darwin.

Personnel List

Ray Binns	CSIRO Exploration and Mining	Chief Scientist, Geology
Terry Kilya	Geological Survey of PNG	Geology, PNG Rep.
Joanna Parr	CSIRO Exploration and Mining	Geology
Tim McConachy	CSIRO Exploration and Mining	Geology
David Dekker	CSIRO Exploration and Mining	Geophysics

David Cousens	CSIRO Exploration and Mining	Geophysics
Peter Franzmann	CSIRO Land and Water	Microbiology
Luke Zappia	CSIRO Land and Water	Microbiology
Peter Nichols	CSIRO Marine Research	Microbiology/Chemistry
Mark Rayner	CSIRO Marine Research	Micro/Hydrochemistry
Lindsay Pender	CSIRO Marine Research	ORV Cruise Mngr & Computing
Philip Adams	CSIRO Marine Research	ORV Electronics

This cruise plan is in accordance with the directions of the National Facility Steering Committee for the Research Vessel Franklin.

Ships Manager
CSIRO Marine Research

Figures.

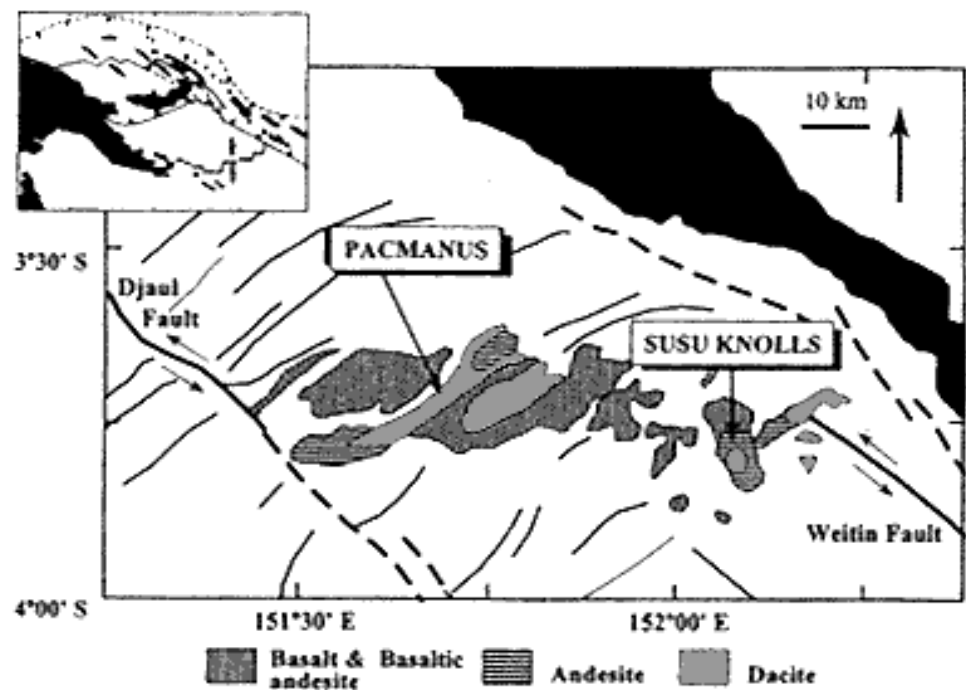


Fig. 1: Main area of operations

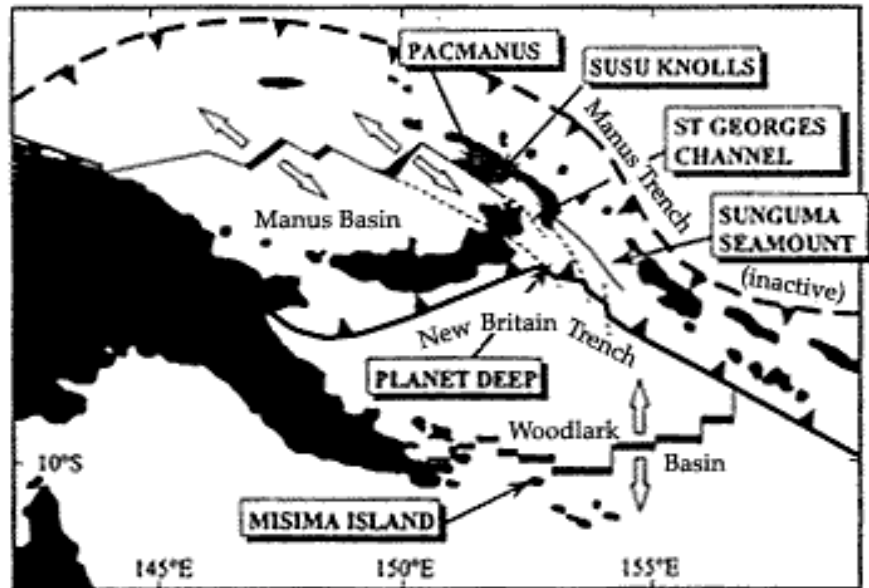


Fig. 2: Cruise track passes west of Misima, across Planet Deep, to St Georges Channel thence SuSu-PACMANUS area of Fig 1.

Updated: 31/01/03

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