FRANKLIN

National Facility
Oceanographic Research Vessel

CRUISE SUMMARY

R/V FRANKLIN

FR 09/97
PACMANUS-IV

Departed Brisbane 10:24 Friday October 10
Returned Townsville 08:00 Monday November 3

Principal Investigators

Dr Ray Binns, CSIRO Exploration and Mining
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Itinerary

Departed Brisbane 10:24 Friday October 10
Via Jomard Entrance and St Georges Channel to the Bismarck Sea
Returned Townsville 08:00 Monday November 3

Scientific Program

Title: Seafloor Hydrothermal Activity in the Manus Basin, PNG

General Objective: Study seafloor hydrothermal ore-forming activity in order to develop improved methods of exploring for ancient mineral deposits on land that originally formed by similar processes.

Specific Objectives:

- Further survey and sample hydrothermal deposits at the SuSu site discovered during the PACMANUS-III Cruise (FR10/96) in the eastern Manus Basin
- Profile sampling of the hydrothermal plume at SuSu
- Collect diffuse vent fluids from the low-T Snowcap field at the PACMANUS site, eastern Manus Basin, and also from SuSu Knolls, using a simple vent fluid funnel (VUNL).
- Conduct bottom photography and sampling to complete the survey of the PACMANUS site
- Test other volcanic edifices near SuSu Knolls (Nimab, Tumbo, Lunar Cone) for hydrothermal activity
- Test the "Weitin Graben" near New Ireland for hydrothermal activity
- Conduct echosounding within St Georges Channel and the Planet Deep to clarify the geometry of major fault structures
- Characterise a seamount near the Planet Deep (crossed by FR01/93) and test it for hydrothermal activity
- During the return passage, characterise one seamount in a cluster of neovolcanic off-axis structures east of Misima Island

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Results

Although inclement weather and faulty DGPS reception prevented our achieving the same high precision positioning during operations as we enjoyed last year, FR-09/97 nevertheless achieved virtually every specific objective listed above and collected valuable new data and samples.

At SuSu Knolls, we mapped out the extent of the Suzette chimney field, located and sampled a new and extensive field of chimneys on the crest of North Su, and found scattered massive sulfide deposits on South Su. The higher hydrothermal plume recorded last year had changed in orientation and characteristics: we discovered that it was quite acid, and tracked its source to a very active smoker field on North Su. Both the deeper plume of 1996, and acoustic emission from South Su, had ceased this year, leading us to suspect we have witnessed a "superplume" associated with eruptions contemporaneous with the 1994 activity at nearby Rabaul. We collected a variety of fresh and altered host volcanic rocks, and a suite of sediments at varying distance from the chimney fields which will be used to assess "mineralisation vectors" caused by fallout of plume particulates.

At PACMANUS, we mapped the southwestern borders of the Roman Ruins chimney field and found it to be exceptionally active. We also discovered and mapped out a new hydrothermal field of sulfide chimneys and oxide deposits at a site southwest of Snowcap, near where a Japanese submersible cruise located chimneys in 1996. Attempts to sample this and also the Rogers Ruins field were only partly successful. Two outlying eruptive centres at PACMANUS were tested for hydrothermal activity with negative results.

Elsewhere in the eastern Manus Basin, we tested 4 major and 3 minor volcanic edifices, one of which (Nimab) is hydrothermally active at its crest where oxide deposits were sampled. Winds and currents prevented our testing and sampling the "Weitin Graben" near New Ireland although we established the exact position of a small volcano on its sedimented floor. Both in the Manus Basin and the approaches to St Georges Channel, we conducted echosounding that has resolved the near-shore links between major seafloor and land structures. In particular, the Weitin, Djual and Wide Bay Faults are major crustal features in both environments, the former extending to the Solomon subduction trench. The inflection in the New Britain - Solomons Trench was shown to be segmented, with the character of a triple junction.

A novel intention of the cruise was to collect diffusely venting hydrothermal fluids from the Snowcap low-temperature hydrothermal field at PACMANUS, using a funnel with Niskin bottle and temperature sensor which was lowered to the sea floor on the CTD cable. With this, we demonstrated the feasibility of "pogoing" the funnel around the seafloor and holding it fixed for up to half an hour. Unfortunately the weather and DGPS "spiking" hindered placing it on the exact target. On the one occasion we achieved this, a shark destroyed the transducer with which the sampling bottle was to be triggered. The experience has suggested desirable alterations to the apparatus.

Another fine day, with choppy sea and mild following swell. Approaching the New Britain Trench, **Echo-sounder profile MES-16** aimed at resolving structure of the trench, but at first the signal was being terminated at 7500m. After leg MES-16A crossed the trench just below 7500m (est 7550), it was realised sampling interval dictated maximum range, something not mentioned in the manual. Changing the sampling interval from 0.25 to 0.5 metres overcame the depth limit. The crossing traverses were slowed to 6 kts over deep water to improve the bottom signal. Link leg MES-16B encountered a scarp not anticipated from Navy soundings. Leg MES-16C crossed and recorded the trench from north to south at 7500m maximum depth. Following link leg MES-16D, northerly leg MES-16E crossed two deeps on the trench, at 7500 (southern) and 7800m (northern) depth. The survey, combined with earlier Franklin data, established a definite displacement and possible rotation of the trench at a position close to the extension of the Wide Bay fault. Leg MES-16E continued north up the approaches to St Georges Channel, providing new data along a longitude not previously traversed.
Echosounder profile MES-17 commenced with westerly leg MES-17A into Wide Bay.

Day 7: Thursday October 16th

Echosounder legs MES-17B and C made two approaches within 2.5 miles of the southern shore of Wide Bay to locate the 1000m contour. Many scarps are present within the fault zone. Leg MES-17D heading northeast again crossed the main fault at 2000m depth. Legs MES-17E and F were transits up the eastern coast of New Britain to the vicinity of Put-Put Harbour, where Legs MES-17 Z and G to M zigzagged in close to the coast to locate the 1000m isobath. This established that scarps representing the two orthogonal faults (Djual extension, and "Duke of York" faults) in this area intersect at a high angle. The plateau on land, formed of Upper Miocene-Pliocene SiguleVolcanics, shows no sign of being cut by the Djual Fault, providing an age limit on its movement in this area. Raised coral terraces indicate the east coast of New Britain is rising.
With strengthening wind and swell, **Echosounder profile MES-18** commenced from near Cape Gazelle with an easterly track (MES-18A) followed by a northeasterly leg (MES-18B) across St Georges Channel to the coast of New Ireland near Cape Senang, which established that there is no offshore expression of the Sapom Fault. By contrast, after link legs MES-18C and D, easterly leg MES-18E (approaching Matop Plantation on New Ireland) then northwesterly leg MES-18F found a conspicuous graben deepening to the northwest as the offshore expression of the major Weitin Fault.
Echosounder profile MES-19 (legs A and B) was a short crossing to locate the peak of a small volcano in the Weitin graben, evident on Moana Wave (1986) sidescan and seismic. This proved only 150 metres high, with a possible summit crater.
After several waypoint changes required by the stiff wind **Hydrocast MH-49** was planned as the first of several operations at this site, to test for hydrothermal activity. However the 20 kt southerly combined with a 3 kt current to the north required the operation to be aborted at 400m depth (CTD kiting in the current). We then transited across to SuSu expecting more sheltered conditions. The wind was still 20 kts now from the southeast, swell was similar, but the current was less at around 1 kt.
Hydrocast MH -50 was sailed northeasterly to a point just south of the Nimab volcano, finding an intense high level plume (1080-1180m), consistently with 3 layers, the central one very narrow but very intense (to 8% reduction in transmissivity). The lower plume found last year at SuSu was almost imperceptible here. A good course was made by crabbing (driving then drifting), but speed across ground was only 0.5 kts. Plume samples were taken on the final upcast close to Nimab, and filtering of these commenced. A 0.3 reduction in pH at the plume was measured.
Echosounder profile MES-20 (legs A and B) located the exact crest of Nimab.

Da y 8, Friday October 17th

Dredge MD-85 was then deployed near the crest into the 20 kt southeasterly wind, returning after good bites with a broken weak link and near-full load of large and small blocks of part-altered or weathered volcanics from a talus dump. Some smaller blocks of low density appeared extensively altered. Chips from the sediment traps were mostly

Returning to Townsville, we examined a seamount in the Solomon Sea near Bougainville first noticed on Franklin FR01/93 echosounder trace. This proved to be a foundered atoll, which we have named ***Sunguma Seamount*** ("Ghost"). In the Woodlark Basin, we dredged one of a cluster of recently-discovered off-axis seamounts, which we named ***Plibersek Seamount*** after a recently-deceased colleague. This proved not to be hydrothermally active. While passing Misima Island, a sediment sample was grabbed from a basin used for tailings disposal by Misima Mines: this will be a future reference in environmental studies.

Cruise Narrative

RV *Franklin* arrived at ANL Wharf, Newstead, Brisbane at 15:00 Thursday 9th October, and we immediately commenced loading scientific equipment while the ship bunkered and took stores. All gear was loaded before a function and tour of the ship held from 16:30 to 18:30 for some 30 visitors including Brisbane-based exploration geologists and CSIRO staff from Pinjarra Hills. Scientists remained on board overnight.

Day 1: Friday October 10th

Cast off from Newstead Wharf at 10:24 and proceeded down Brisbane River and across Moreton Bay under perfect weather conditions and smooth water. After dropping the pilots off Maroochydore at 15:56, a slight swell was encountered. Unpacking of gear, assembly of equipment and setting up of laboratories dominated the day's activities. Boat drill at 16:15 was followed by Masters safety meeting with scientists.

Day 2: Saturday October 11th

Fine weather and calm seas with slight swell while transiting north. The day was occupied preparing equipment and computer systems.

Day 3: Sunday October 12th

Fine weather and calm seas again, with a slight swell during continued transit. The trackPlot display system was installed and modified, and a separate PC was set up to log and record navigational, depth and winch data during operations. Two watches then conducted "dummy" echosounder runs, finding a number of problems to be rectified.

Day 4: Monday October 13th

Crossing the Coral Sea, with fine weather and slight following swell. Following a restart to trackPlot logging and other modifications, a third dummy run was conducted successfully. Further assembly and testing of apparatus revealed some problems with one video camera and the SDL temperature sensor.

Day 5: Tuesday October 14th

Passed through Jomard into the Solomon Sea at 04:45 with calm conditions. Near East Island, a pressure test of video and camera housings, the submersible data logger, and the vent-fluid funnel (VUNL) temperature sensors was conducted by lowering these to 1050m on the camera cage. The response of the broadbeam transducer to reflected pinger signal off bottom was also tested. All items passed the test, though some problems were experienced with drop-out of DGPS while trying to maintain station, and in the trackPlot recording. Abeam Woodlark Island at 19:30. Swell increased to slight after passing across the Trobriand Trough.

Day 6: Wednesday October 15th

altered, and included fragments of Fe and Mn oxide crust, a few glassy fragments, and a tiny tube worm.
Camera-Video tow MCV-40 was intended to be a southeasterly track placed just east of 1996 tracks to delineate the Suzette chimney field at SuSu Knolls, but the strong wind forced the ship to the northeast and video of sediment-covered flank of Suzette ridge was taken. The 35mm camera strobe was accidentally left off.
Sediment core MS-40 was to have been the first in a grid surrounding Suzette, but the closure flap allowed loss of recovered sediment apart from a little dark sulfidic grit. A lead billet was added to the lid, and the hingepin slot enlarged in an attempt to overcome this problem.
Dredge MD-86 was aimed as a southeasterly haul at volcanic outcrops photographed last year northwest from Suzette, but the 20 kt wind prevented a hovering deployment. The dredge dropped early and after showing no bites returned only a moderate load of variegated ooze, ranging from brown to grey.
Hydrocast MH-51 extended the track of MH-51 further east of Nimab, finding a declining 1080-1180m plume as the Weitin Graben was approached.
Grab MG-23 was placed over a highly reflective zone on the Moana Wave sidescan sonar image, along the foot of a scarp extending northeast from Nimab to the Weitin graben. A full grab of normal hemipelagic sediment, reddish brown overlying olive, was recovered. There were no rocks to indicate the source of the sidescan feature.
Sediment core MS-41 was deployed, without a pinger, nearby at the foot of Nimab. The modified closure worked well, but the corer was apparently halted too quickly and returned only a 40cm section of hemipelagic ooze.
Dredge MD-87 was deployed southeast, into the continuing 20 kt southeasterly and choppy sea, on a small volcano south of Nimab, evident on the sidescan image. The deployment was near-perfect, and the weak link did not fail even though the dredge caught on an outcrop and the ship was hauled back to the deployment position. The haul returned a good load of volcanic fragments immersed in ooze.

Day 9, Saturday October 18th

With winds subsiding slightly to 12 kts from the southeast, **Camera-video tow MCV-41** was a highly successful, short multiple hover operation across the crestal zone of Nimab volcano. The conditions, and also alarmingly erratic DGPS corrections, caused considerable movement of the ship, despite which the camera appears to have moved slowly along the planned track. Unusual laminated outcrops (altered volcanic?), and scattered mounds and chimneylets of red to yellow, dark-crusted hydrothermal deposits were recorded. Some have bacterial coatings and haloes, but fauna is sparse overall and of low-T vent type (anemones, corals, crinoids). The submersible data logger failed after 15 minutes
Hydrocast MH-52 was placed between the new Nimab tracks and last year's SuSu grid, to test for continuity or otherwise of the two. The 1150-1180m plume was intense initially and, though declining, still quite high after passing north of Nimab.
With winds at last abating to an 8 kt southeasterly, **Dredge MD-88** was hauled with precision across the crest of Nimab, following the track of MCV-40. Red, grey and brown hydrothermal sediments, some Fe crusts, and large fragments of pumice were recovered.
Sediment core MS-42 was taken near the Suzette chimney field to collect bottom samples expected to contain settled plume particulates. About 27 cm of unconsolidated dark grey to black grit was recovered.
Having observed a major discrepancy between wire-out measurements and depth on impact, an inspection was carried out of the main GO-block to check all magnets were being sensed, and to remeasure its diameter. A correction of 3.8% was made in the software, increasing subsequent measurements more closely to bottom depth.
Increasing southeasterly winds required **Camera-video tow MCV-42** to be switched at the last minute from a planned southwesterly track across Suzette to a 1-hour, 1-lamp southeasterly track with two intermediate hovers across the crest of South Su. Good video of three separate hydrothermal deposits was taken.

Hydrocast MCV-53 was a single dip placed just west of South Su where the most intense parts of the upper and lower plumes were found in 1996. Surprisingly, neither plume was found here, indicating a strong easterly bottom current. A profile of water samples, effectively a reference background set, was collected. During this cast, the SDL was attached to the rosette allowing its P and T measurements to be calibrated against the CTD. Temperature measurements were very close, but pressure required application of a correction formula.
Commencing an overnight circle of lower precision operations away from SuSu while wind conditions were unfavourable, **Dredge MD-89** was aimed at a scarp on the northern side of a small ridge northwest of SuSu, unsuccessfully dredged in 1993. With strong winds causing difficulty with station holding, the dredge dropped early and once again only mud and pumice were recovered.

Day 10, Sunday October 19th

Sediment core MS-43 was deployed into a shallowly enclosed sedimented basin to the west of SuSu, testing negatively for indications of any brine pool. A short 30cm core of normal hemipelagic sediment with two ash layers was recovered. Sediment was pouring from the nosecone while hauling on deck, so further modifications to the closure were undertaken - a pad of insert rubber was glued to the lid.
Dredge MD-90 experienced only minor "nibbles" but recovered a good load of basaltic fragments and mud from the Tumbo volcano.
Hydrocast MH-54 was planned as a tow-yo near Tumbo to test whether it and an adjacent feature were hydrothermally active. A 0.6% transmissometer anomaly at 1200m was considered discouraging at this stage, so the tow was terminated after only one dip. With morning, wind conditions appeared again to be improving, so a planned dredge on a lava field at west Tumai Ridge was postponed and we returned to SuSu, where **Grab MG-24** was taken just east of Suzette. A good haul of black sulfidic mud was made, with pale grey mud below.
Camera-Video Tow MCV-43 was the postponed 1 hour southwesterly traverse across the Suzette chimney site. Excellent images of chimneys and fauna were obtained, and a 30cm chimney sample with live barnacles attached was sampled during a crash, arriving jammed in the cage.
Grab-MG-25 aimed at collecting another sediment sample for plume particulate studies, this time north of the Suzette chimney field. On the first attempt the jaws did not close, and the second hit a chimney, recovering many small fragments. This extends the Suzette field another 200m, if there is a continuous line.
Dredge MD-91 was attempted as a precision operation into a stiffish 12 kt wind and half kt northerly current onto one hydrothermal site photographed by MCV-42 on South Su. The deployment was excellent, and a load of dark sulfidic mud with fauna was returned.
Grab MG-26 provided another good sediment sample near Suzette, this time with black mud overlying grey overlying a gritty hyaloclastite with a few larger volcanic fragments presumed to be the surface of an underlying flow.
Hydrocast MH-55 was another 5-mile traverse between SuSu and Nimab. Again we found there was no plume signal south of SuSu where in 1996 the plume was strong. A narrow but erratically intense plume layer at about 1100m was then encountered to the east. This decreased but was not closed off at the northeastern end of the tow. A computer crash near the end lost some data.

Day 11,Monday October 20th

Camera-Video Tow MCV-44 was our first 2-hour run this cruise, starting north of Suzette to intersect the field extension indicated by MG-25, and then following the contours of the eastern flank of this knoll to the col between it and South Su. Inactive chimneys were recorded early in the tow. The SDL did not function on this tow.
With improving wind conditions, **Dredge MD-92** was deployed on a second zone of hydrothermal deposits photographed by MCV-42. A variety of altered volcanics, some with native sulfur, and many galatheid crabs plus other "low-temperature" fauna were recovered.

After a delay while faulty controls of the side A-frames were attended to, **Sediment core MS-44** was taken in a shallowly enclosed basin to the east of SuSu. The contents washed out during recovery, and only a small amount of gritty sediment was recovered.
Dredge MD-93 was deployed on a third hydrothermal site photographed by MCV-42 on South Su. A small load of very fresh (possibly a recent flow) and altered volcanics was recovered.
Dredge MD-94 was deployed accurately onto the centre of the Suzette chimney field, between two 1996 dredges. After good bites, the dredge returned with a quarter load of chalcopyrite-rich chimneys and black sulfidic mud.
Camera-video tow MCV-45 was the first traverse this year across the crest of North Su. The camera became anchored on two occasions, and was freed by reversing the ship's movement. The video camera recorded hydrothermal deposits along most of the track, and the data logger detected two temperature anomalies, of 13 and 4 degrees C. Massive sulfide fragments were collected by the camera during a collision.
Dredge MD-95 was deployed on the same target as MD-91 on the crest of South Su, returning a moderate load of massive sulfide fragments, predominantly of barite-sphalerite with no orifices.
Grab MG-27 was deployed on the eastern side of Suzette, returning unaltered dark grey to black silty sediment with many worm tubes surrounded by paler grey bioturbated mounds protruding from the undisturbed surface.
Hydrocast MH-56 was another 5-mile northeasterly tow-yo traverse starting just southwest of North Su and passing just south of Bugave Ridge to map out the SuSu plume. Transmissometer anomalies occurred on all casts, more intensely in mid-track. With previous hydrocasts, North Su was clearly indicated as the plume source.

Day 12, Tuesday October 21st

Sediment core MS-45, a repeat of MS-44, attempted to sample the basin east of SuSu. It returned with the cable caught on the tail fins, which caused loss of most of the sample. Only a trace of dark gritty sediment as recovered.
Grab MG-28 was another sampling of bottom sediments east of Suzette for detecting geochemical zonality arising from settled plume particulates. It returned with the cable tangled around the grab, causing the load of grey mud with black streaks and sandy patches to have been disturbed during the haul.
Hydrocast MH-57 was a single dip to collect a profile of water samples just east of North Su near the 1997 eye of the plume. Eleven bottles were fired between 1500m and 1000m, including 3 in the most intense plume layer (51% transmissivity reduction). The pH of peak plume samples was distinctly lower than seawater, and one bottle smelled faintly of H2S. Samples were reacted with cadmium nitrate for later measurement of H2S abundance.
Dredge MD-96 was aimed at hydrothermal deposits on North Su, photographed at the start of MCV-45. It returned a load of fresh and altered porphyritic dacite, some with native sulfur globules, plus a few chimney fragments.
Grab MD-29 was deployed in the basin east of SuSu where two previous attempts to sample by corer had been unsuccessful. Unlayered, black sulfidic mud, smelling of H2S, and a large block of pumice were recovered. The gritty nature of the sediment probably explains the difficulty in coring. This operation indicated that the influence of settled material from the SuSu plume extends at least 5 km to the east.
Camera-video tow MCV-46 was a southwesterly traverse to test the southerly extent of the Suzette chimney zone. Despite only light 5 kt northeasterly winds, very erratic DGPS positioning prevented good hovering and accurately maintaining track. No chimneys were observed, so this field has been closed off to the south.
Wind increased to a 15 kt southeasterly for **Grab MG-30**, designed to collect a sediment sample at the eastern foot of North Su, directly under the intense plume. A load of black volcanic sand and gravel, with graded bedding, was recovered.
Dredge MD-97 was the second aimed, under windy conditions, at deposits on the crest of North Su, photographed by MCV-45. This anchored after strong bites, and the main and second weak links broke. The ship had not been fully halted for the haul. Chips of glassy

porphyritic dacite, and fragments of sulfide-sulfate chimney were caught in the fishnet liner.
Grab MG-31 was placed further east than MG30 on the foot of North Su, and returned a load of stratified sand and granule gravel with small volcanic rock fragments.
The strong winds being experienced were clearly going to prevent precision operations, the only kind remaining to be done at SuSu Knolls, so a transit was commenced to PACMANUS where we hoped more protected conditions might allow further work.

Day 13, Wednesday October 22nd

Dredge MD-98 was intended to sample the Rogers Ruins chimney field, but landed 200m east of the target due to an error in the waypoint. A large load of dacite was returned.
Camera-video tow MCV-47 traversed the crest of Sonne Pimple, seeking hydrothermal activity and also assessing the relative youth or otherwise of this feature. Variable currents caused some problems with the hover operation. No deposits or faunal accumulations were seen, and a normal degree of ooze cover was observed.
Grab MG-32 was deployed at a location west of Snowcap where our 1993 photography and a ManusFlux *Shinkai-6500* dive observed extensive deposits of Fe-Mn oxide on lobate lava flows. Several large spires of friable Mn oxide were returned.
Dredge MD-99 sampled the crest of Sonne Pimple, which had probably been missed by an attempt in 1996. A half bag of glassy andesite with delicate ropy pahoe-hoe surfaces coated by mud was returned, confirming this edifice as an independent small eruption centre.
Grab MG-33 was dropped on another field of Fe-Mn oxide deposits observed southwest of Snowcap by *Shinkai-6500*. The jaws did not close on all of three attempts, and no sample was obtained. The trigger mechanism needed lubrication.
With the wind dropping to a 5 kt easterly, **Dredge MD-100** was aimed as a precision deployment at the southwestern edge of the Roman Ruins chimney field. Erratic DGPS positioning frustrated the attempt. The dredge dropped a little west of the border, but after a single bite recovered a useful load of Fe-Mn oxide crusts on dacite - representing the fringe of the field.
Camera-video tow MCV-48 crossed a small eruptive centre or knoll on the eastern flank of Pual Ridge, where a dredge in 1996 recovered Fe-stained dacites with a number of galatheids. However no indication of hydrothermal activity was encountered.
With winds again rising, **Grab MD-34** was the fourth attempt to sample oxide deposits at the second *Shinkai-6500* site. It evidently hit a lightly sedimented lava surface, recovering without disturbance a 5cm unit of reddish ooze overlying a glassy lava crust.
Grab MD-34R was repeated on the same target, and successfully recovered cohesive slabs of Mn oxide crust overlain by mud.
With high winds again discouraging precision operations, a diversion was made to the Marmin Knolls area west of PACMANUS.

Day 14, Thursday October 23rd

Hydrocast MH-58 was a single dip testing a shallowly enclosed basin within a valley feature between knolls, where a BMR seismic profile possessed an apparent "false bottom" signal, possibly a brine interface. No salinity anomaly was observed near bottom, nor was there a transmissometer anomaly. A profile of salinity standards was taken.
Sediment Core MS-46 was taken in this same basin to see if it was exceptional sedimentologically, returning 84cm of normal banded ooze with several ash layers.
With the ship heaving markedly in a strong swell, **Dredge MD-101** successfully sampled a high feature at the western side of Marmin Knolls, whose linear structure suggested a different character to the conical basaltic volcanoes previously dredged here. A full bag of olivine-bearing pillow basalt was recovered, similar to other samples from Marmin Knolls.
Returning to PACMANUS, **Dredge MD-102** at the southwestern side of Roman Ruins was aimed a little east of MD-100, and after big bites returned only a small but interesting load of chimneys , some evidently active, and one older with attached barnacles.

The first attempt to use VUNL to collect vent fluids at Snowcap was planned for mid morning hoping for calmer conditions, but was postponed because of continuing strong swell.
Grab MD-35 was instead deployed on the first *Shinkai-6500* site hoping to hit Fe rather than Mn oxides, but again the jaws did not close, probably because one trigger leg hit a rock.
Camera-video tow MCV-49 was a northeasterly track across a poorly-explored part of the Roman Ruins field. Even with lighter winds, holding this track proved difficult. Inactive chimneys, mounds and crusts were encountered during the first third of the tow.
Dredge MD-103 was aimed at a field of oxide crusts apparently without chimneys, well southwest of Snowcap, encountered by our 1991-1993 photography. The dredge was anchored for 30 minutes, but eventually returned with weak links intact and a good load of dacite and Fe oxide crusts, some still attached to lava surfaces.
Camera-video tow MCV-50 was flown up the central part of Pual Ridge, in a gap between previous photography. Chimneys and a 1.4°C temperature anomaly were encountered soon after the start of the tow, forming a new field which may be continuous with chimneys reported to the west by *Shinkai-2000* on the 1996 BioAccess Cruise of *RV Natsushima*.

Day 15, Friday October 24th
With 15 kt winds again discouraging precision operations, a circuit was conducted to the north and northeast of PACMANUS, finishing at SuSu Knolls.
Sediment Core MS-47 was taken in another shallow enclosed basin within a valley northeast along strike from Pual Ridge. A 106 cm core, the best of the cruise, was recovered, containing 9 beds, principally turbiditic but including 4 ash layers.
Sediment Core MS-48 followed in the large basin further north, approaching the Weitin Fault, yielding a 53cm core.
Dredge MD-104 was deployed onto a razorback ridge near the Weitin Fault, after a delay repairing the net with ship heaving in a 2m swell. The dredge dropped too low on the scarp, and broke its main weak link ,probably because of heave since there were no exceptional bites. A small amount of ooze and washed pumice fragments were returned.
Dredge MD-105 repeated this operation, achieving the scarp and recovering brown and olive green mud with Mn-stained or weathered basalts of older appearance, possibly basement. A patch of grey ash was present in the mud.
During the later stages of this operation, the FDCS-User computer monitor crashed, requiring the system to be re-booted and ancillary displays to be reset, taking about 2 hours during which no winch operations were possible. Also, it was confirmed that the ship's gyro compass was reading up to 20 degrees in error. This means that all ACDP current readouts to this stage of the cruise were spurious. Logging was transferred to the standby gyro.
Sediment Core MS-49 was taken in the large basin north of Tumai Ridge and west of Bugave Ridge, returning a 46cm core of normal sediments plus an ash layer in the core catcher.
Dredge MD-106 was dropped on a sloping lava field at the northwestern end of Tumai Ridge, indicated by reflective patterns on the *Moana Wave* sidescan sonar mosaic. Despite becoming anchored, it returned only mud. Like MD-23, this feature is evidently well covered by sediment. An unusual and unexplained 1-tonne oscillation in tension occurred during the haul after leaving bottom.
Echosounder profile MES-21 was sailed at 5 knots across the peaks of North Su and South Su, listening for acoustic emissions of the kind frequently encountered in 1996. None were recorded on either the scientific 12 kHz or the bridge 35 kHz sounders. Presumably this correlates with the absence this year of a 1550m deep plume.
Camera-video tow MCV-51 was a second traverse across the crest of North Su, 200m east of MCV-45. Southerly 20 kt winds made hovering difficult. Chimneys and a temperature anomaly were recorded early in the tow, and more chimneys and black smoke towards the end.

The strong winds again forced abandonment of precision operations overnight, and a circuit of lower precision "regional geology" dredges to the south, ending at PACMANUS, was planned.
Echosounder profile MES-22 was a crossing to locate the crest of a small volcano south of SuSu Knolls, apparent on the *Moana Wave* sidescan mosaic.
Dredge MD-107 attacked the southwestern side of this volcano, recovering basalt fragments and mud.

Day 16, Saturday October 25th
Dredge MD-108 was placed by moving to the 1940m isobath on the northwestern flank of another small volcano evident on the sidescan mosaic southwest of SuSu knolls. This sits above a promontory between a NE-striking extensional fault and a NW transform-parallel fault. Besides scoriaceous basalt, the dredge recovered large blocks of semiconsolidated mudstone and smaller pieces of sandstone, apparently representing the upper basement sequence on which this volcano was constructed.
Following a 2-hour delay caused by computer malfunction, **Dredge MD-109** was similarly targeted bathymetrically on the lowest of three steep extensional fault scarps defining the southwestern margin of the eastern Manus Basin. It recovered only ooze and pumice. Intended dredges on the higher scarps were abandoned because we were behind schedule, and since winds dropping to 10 kts hinted at better conditions ahead. The transit to PACMANUS was completed while 50m of kinked wire were removed from the towing cable.
Dredge MD-110 was deployed on chimneys photographed by MCV-50 at the new field on central Pual Ridge southwest of Snowcap. Erratic DGPS again caused problems with placement. The dredge returned with a load of dacite and Mn crusts. Some dacites show possible siliceous alteration.
VUNL Dip MV-01 commenced under less than favourable conditions: 15 kt winds from the ESE, and a 1.5 metre swell. Lowering was conducted at 15m/minute because of the non-hydrodynamic shape of VUNL, and while visible it appeared stable at this rate. Realising the pinger was not turned on, it was recovered after a few minutes and redeployed. Conditions prevented the ship being help at the preferred waypoint during deployment, so every effort was made to keep it within a triangle covering the crest of Snowcap Knoll. Slant ranging on the acoustic release via a transducer lowered 20m below the ships hull was successful. VUNL reached bottom with 1662 metres of wire out, indicating it was on or just beside Snowcap. Eleven "pogos" were then conducted, the VUNL being lifted 10m off bottom and moved randomly while the ship drifted, then lowered again for about 10 minutes. For most pogos, wire out was around 1655-1670m, indication positions close to target. No temperature variation above ambient 3°C was observed. The Bridge trackPlot display crashed part way through the operation, and movement directions were relayed from the Operations Room. Just as we were about to fire the sampling Niskin bottle by acoustic release, the transducer lost contact. On hauling, it was found to be irreparably damaged by shark attack. The VUNL was recovered at 20m/minute, then increased to 40m/minute without any severe tension on the wire. Although no sample was obtained, the operation was a technical success, demonstrating the feasibility of the "pogo" procedure despite quite considerable movement of the ship. Keeping the ship steady and hitting a small target would have been possible under better weather and DGPS reception. However the temperature sensor was clearly not sufficiently sensitive. The acoustic release was removed from the VUNL, and an alternative "messenger" trigger was devised, using a damaged Niskin higher up the wire.
A 2.5 hour delay followed while the computer system was again rebooted.
Camera-video tow MCV-52 traversed the central part of Pual Ridge about 50-100m west of MCV-50. Chimneys and temperature anomalies were again observed early in the tow, expanding this new field.
Dredge MD-111 was aimed at this field for a second attempt to sample it, but dropped 80m off the waypoint due to DGPS spike problems, and recovered only glassy dacite.

Day 17, Sunday October 26th

Dredge MD-112 was deployed under 10kt but dropping winds onto the central southwestern part of the Roman Ruins field. After a 2-hour anchoring, it returned unbroken with a good load of two large chimneys plus many smaller fragments and chimneylets plus, in the lower part of the bag, conchoidal blocks of "explosive" dacite which shattered into smaller fragments while resting on deck. Snails and crabs were also present. Over an hour was taken to clear the afterdeck.
Camera-video tow MCV-53 was a southeasterly tow across the southern part of Roman Ruins, intended to establish relative continuity. Excellent images of smoking chimneys were obtained.
With wind dropping to 5 kts, **VUNL dip MV-02** was undertaken again at the Snowcap site, though during lowering the ship drifted northwest of the waypoints. The SDL was strapped to its side, to provide a better measure of bottom depth at the four pogo sites. These ranged from 1676 to 1707m depth, indicating the VUNL did not arrive on the Snowcap knoll, so it was decided to cut the dip short and re-deploy. Using the messenger, the Niskin was fired on the last pogo (1683m), collecting a presumed "background" seawater sample. No temperature anomalies were recorded by VUNL, but the SDL detected a barely significant 0.04°C rise in ambient temperature just prior to the final (sampled) pogo.
VUNL Dip MV-03 was then deployed on the same Snowcap target, with 6 kt southeasterly winds. Three pogos were made at on-bottom depths of 1682-1686m, too deep to have been on Snowcap knoll. By moving the ship, the fourth pogo depth fell to 1676m. Preparing for a fifth pogo in even shallower bottom nearer the target, the winch controls failed, and VUNL remained 30m above bottom for over an hour. Paying out was deemed inadvisable, so another "background" seawater sample was collected at this position before hauling to surface.
Deployed after an hour's delay, **Dredge MD-113** was a second attempt to collect chimneys from the Rogers Ruins site. After anchoring for 15 minutes, the dredge returned with weak link broken but containing both chimney and dacite samples.

Day 18, Monday October 27th

While there was a 3-hour delay restoring trackPlot to the computers, a side excursion to dump excess rocks was made to the 1996 site at 3°43.0S 151°40.0'E.
Dredge MD-114 was another attempt to collect chimneys from the new field located by MCV-50 southwest from Snowcap. After a severe anchoring, the dredge returned with both main and second weak links broken, and only a few pieces of dacite in the net liner.
VUNL Dip MV-04 was intended to be a single pogo operation deployed under 6 kt winds accurately onto the preferred waypoint, but erratic DGPS corrections again frustrated positioning, and the wire-out indicated VUNL landed north of Snowcap. A second pogo was slightly shallower (retrospectively from SDL: 1682m on bottom), and with time running out the messenger was sent down to fire the bottle, and VUNL was recovered after allowing 20 minutes for it to reach bottom. A bottom water sample was successfully taken, though not at the desired site.
Hoping for equivalent milder conditions at this site also, a transit was made back to SuSu Knolls. On arrival, however, the winds had increased to 25 kts, and the sea state would not allow precision operations. A program of echosounding was commenced in more protected waters near the Gazelle Peninsula of New Britain, aimed at tracing the likely continuation of the Djual Fault.
Echosounding Profiles MES 23 A to F covered a zigzag course following the line of the fault from Ataliklikun Bay westwards. The Djual Fault forms the northeastern shore of Ataliklikun Bay, and changes from a scarp to a graben structure westwards. As occurs further northwest where it is surveyed by swathe bathymetry it is not a simple structure, but contains at least one significant jog.
A northwards transit was then made to the vicinity of Umbo Knolls, where **Hydrocast MH-59** was conducted as a 3-mile tow-yo to test for hydrothermal activity on this large edifice. The result was inconclusive- a slight anomaly (0.4%) occurring at .1150-1200m and a faint anomaly at about 1550m possibly reflecting activity at DESMOS cauldron.

Day 19, Tuesday October 28th

Dredge MD-115 was dropped onto the northwestern slope of the higher, western peak of Umbo, returning a load of mud with two "clean" layers of basaltic hyaloclastite.
Hydrocast MH-60 tested the vicinity of Tumbo Knolls for hydrothermal activity, following up the 0.6% transmission anomaly detected in MH-54. Only a 0.2 % anomaly was found at 1150m, and the tow was terminated after 3 casts.
Returning to SuSu Knolls but with 20 kt winds still blowing, **Dredge MD-116** was deployed on the hydrothermal field on the crest of North Su, photographed by MCV-51. Although an excellent deployment was made, the dredge left bottom after only one small bite and the recovery was only a fistful of fresh porphyritic dacite.
Hydrocast MH-61 was a single dip placed mid way between the proximal and distal sites at which the SuSu plume had been previously collected. A profile of samples taken from 1682 to 900m was filtered to collect plume particulates.
Camera-video tow MCV-54 was a third southeasterly track across the crest of North Su, designed to "close off" the hydrothermal field to its southeast. Chimneys, temperature anomalies and smoke were evident along most of its length, including the final moments where the SDL data indicate that a descent of the southeastern slope had commenced, so the full extent of the field remains unknown.
Dredge MD-117 was again aimed at the deposits on the crest of North Su. After only a few mild bites, the dredge returned absolutely full of pale grey to dark grey altered dacite containing globules of native sulfur. The frequency with which this material has been dredged at North Su suggests it represents some of the vent sites.
With the winds showing no sign of abating, it was decided to terminate operations in the eastern Manus Basin without revisiting the Weitin Graben volcano site where worse conditions were likely.
After a transit past Crater Peninsula at Rabaul **Echosounder Profile MES 24 (Legs A to D)** charted the centre of St Georges Channel, and crossed its eastern fault at the anticipated position. It then passed over rugged terrain south of New Ireland, and crossed a major scarp representing a further southern extension of the Weitin Fault before reaching the vicinity of a seamount unknowingly recorded on *Franklin* oceanographic cruise FR01/93.

Day 20, Wednesday October 29th

Echosounder Profile MES-25 (legs A to C) established the position and height of this feature, which we named Sunguma Seamount (Pidgin for "ghost", reflecting its reappearance and its white shroud as discovered by the next operation).
Dredge MD118 attacked the steep northern face of this seamount at 750m depth. After becoming severely anchored, it recovered a large load of platy fragmental limestone with Mn coated surfaces.
Dredge MD-119 was deployed deeper at 1150m, with the same result. No volcanic rocks were sampled. Sunguma Seamount is clearly a foundered atoll, reflecting depression of the forearc to the Bougainville Trench. A planned hydrocast to test for hydrothermal activity was cancelled as a result.
Echosounder Profile MES-26 comprised Leg A which re-crossed the Weitin Fault, and zigzag Legs B, C and D across the curving part of the New Britain Trench. Leg C recorded a depth of 8800m, the deepest sounding recorded for this part of the trench. To obtain adequate records, it was necessary to slow the ship to 6 kts crossing the deeps, and to split the screen to show both narrow beam and broad beam profiles. The latter gave slightly less resolution but a better return.

Day 21, Thursday October 30th

On completion of MES-26, a transit across the Solomon Sea commenced. A brief slowing occurred early morning to test the emergency steering, and to dispose of kinked cable removed from the main towing wire. Scientists spent the day preparing reports and diagrams. Passed east of Budaduna Is after dark.

Day 22, Friday October 31st

On entering the Woodlark Basin, operation numbers reverted to those of the PACLARK series of cruises.
Echosounder Profile ES-50 was two orthogonal crossings to locate the crest of the northeastern of four off-axis seamounts identified east of Misima Island by *Moana Wave* swathe bathymetry in 1995.
With calm seas and a 7kt southeasterly wind, **Dredge D-46** sampled the western face of this seamount at a depth of 2000m. A large load of pale buff-coloured pelagic ooze was recovered, from which were picked one pillow segment and a number of rind glass shards of ferrobasalt with thin Mn crust. Having characterised this feature, we named it ***Plibersek Seamount*** in honour of Phillip Plibersek, Placer Pacific geologist colleague of the CSIRO members, who was fatally attacked in Port Moresby a few days before our cruise commenced.
Hydrocast H-36 was a tow-yo from the west across the crest of Plibersek Seamount, which detected no evidence at all of a hydrothermal plume.
After a short transit to Misima Island, **Grab G-3** was taken in a deep basin offshore from the Misima Gold Mine, the site of tailings disposal. A 1.5 cm thickness of unconsolidated graded sand overlying stickier silt was recovered and sampled for future environmental studies.
Packing of equipment commenced as the transit southwards continued with passage of an un-named strait south of the Deboyne Islands just before sunset, with splendid views of reefs, cays, and the Calvados Chain of islands. Jomard Entrance was passed at 21:00.

Day 23, Saturday November 1st
Transit across the Coral Sea, with a slight easterly swell abeam providing fast and comfortable sailing. Packing of gear and report preparation continued. A debriefing meeting of the chief scientists, cruise managers, master and chief engineer reviewed operational aspects of the cruise. Results of the cruise were discussed at a Science Meeting, and in the evening a video presentation was given for the ship's complement of 1996 and 1997 shipboard highlights and of seafloor video taken this cruise.

Day 24, Sunday November 2nd
Transit across the Queensland Plateau, while packing continued. Abeam Racon Beacon with distant views of Hinchinbrook and Palm Islands at sunset,18:30.

Day 25, Monday November 3rd
Collected the Pilot at 07:00, and berthed at No 8 Wharf, Townsville at 08:00. Unloaded Canadian equipment at 09:00, and Sydney equipment at 11:00.

Summary

The Principal Investigators are highly pleased with the outcomes of FR-09/97. Apart from the differential GPS receiver installed shortly before this cruise, and occasional computer crashes and problems with the side winch controls, all systems and equipment on the vessel performed well. Time out was minimal. *Franklin* has again demonstrated its suitability for deepwater marine geoscientific research in reasonably protected waters.

The Co-Chief Investigators wish specially to acknowledge the vital contributions of the ship's crew and ORV Facility staff to the success of PACMANUS-IV, through precision handling of the ship often in difficult conditions, unflinching work at the winch controls, assistance on the quarter-deck, maintenance and repair of ships

equipment and scientific apparatus plus innovative fabrication of minor apparatus, and attention to personal comforts.

Personnel

Scientific Party

		Watch
Helen Beggs	CSIRO Marine Research, Hobart	1-13
Ray Binns*	CSIRO Exploration and Mining, Sydney	
Keith Crook#	HURL, University of Hawaii, USA	7-11
Dave Edwards+	CSIRO Marine Research, Hobart	13-1
Ann Huff	Dept of Geology, University of Toronto, Canada	7-11
Leanne McDonald	CSIRO Exploration and Mining, Sydney	3-7
Roger Moss	Dept of Geology, University of Toronto, Canada	11-3
Roselyn Mua	Dept of Geology, University of PNG, Port Moresby	7-11
Steve Scott** #	Dept of Geology, University of Toronto, Canada	3-7
Robina Sharpe	CODES, University of Tasmania, Hobart	11-3
John Waters#	CSIRO Exploration and Mining, Sydney	11-3
Chris Yeats	CSIRO Exploration and Mining, Sydney	3-7

* Chief Scientist at Sea ** Co-Chief Scientist + Cruise Manager # Watch Captain

Ship's Crew

Neil Cheshire	Master	Wayne Browning	Able Seaman
Arthur Staron	First Mate	Bill Hughes	Able Seaman
Allan McCarthy	Second Mate	Gerry O'Halloran	Able Seaman
John Morton	Chief Engineer	Phil French	Greaser
Greg Pearce	First Engineer	Gary Hall	Chief Cook
Andrew McLagan	Electrical Engineer	Peter Dux	Second Cook
Peter Genge	Bosun	Ron Culliney	Chief Steward

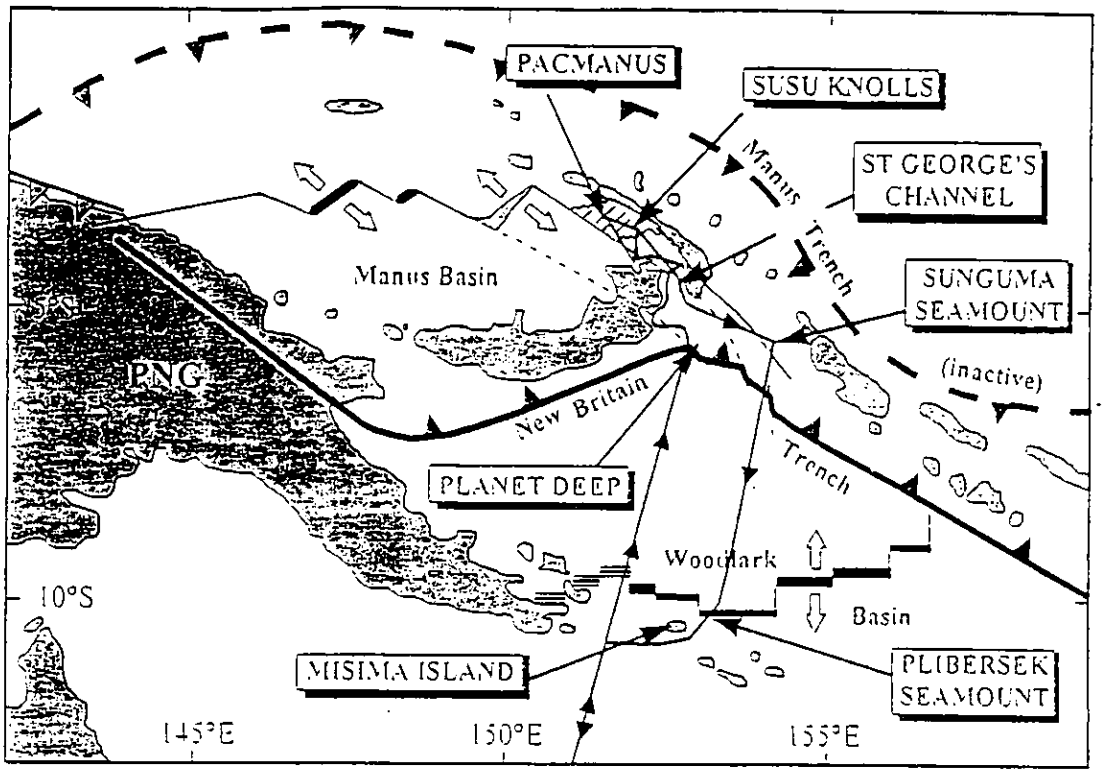

Fig. 1 Cruise track

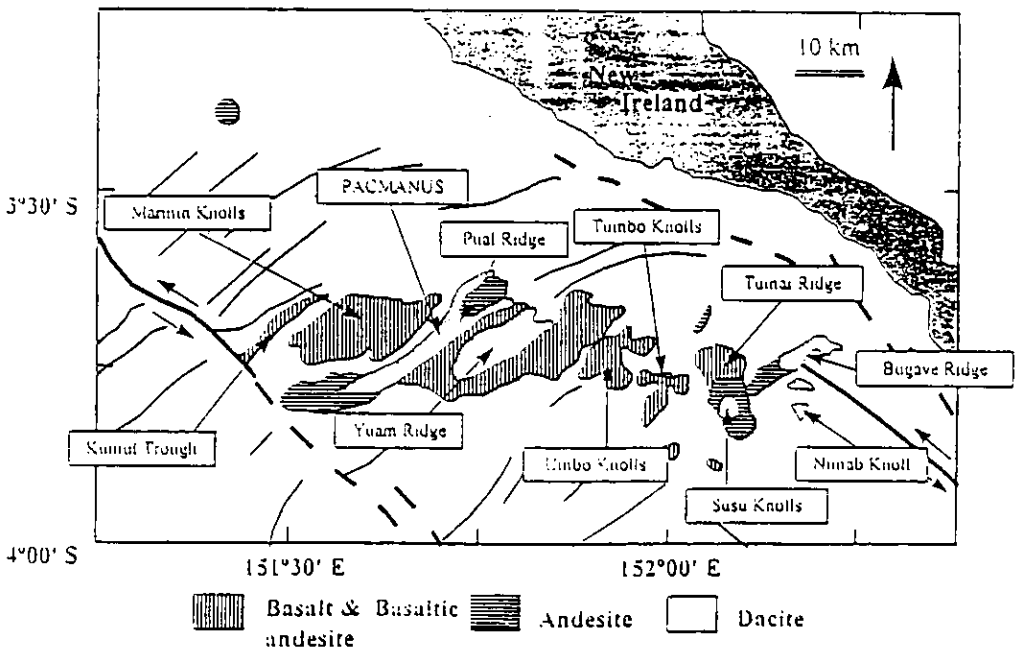

Fig. 2 Place names cited in this report for the Eastern Manus Basin

APPENDIX: Station List

APPENDIX: STATION LIST FR 09/97 PACMANUS-IV 08 OCTOBER - 03 NOVEMBER 1997

Note: A calibration factor of 1.064 should be applied to 'wire out' readings from all dredge, camera tow and sediment core operations up until 18:00 hrs on 18/10/97. This is to correct for a calibration error of the GO Block on the tow winch (see cruise log pgs 194, 197, 229).

Table of contents:

New Britain Trench/Planet Deep

Echosounder Profiles

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)
MES-16A	15/10/97	start	10.42	06°00.00'	153°04.87'	5674
	15/10/97	end	13.03	05°37.94'	153°11.03'	3791
MES-16B	15/10/97	start	13.03	05°37.94'	153°11.03'	3791
	15/10/97	end	14.21	05°36.00'	152°56.14'	4470
MES-16C	15/10/97	start	14.21	05°36.00'	152°56.14'	4470
	15/10/97	end	17.14	06°00.05'	152°50.00'	5750

MES-16D	15/10/97	start	17.14	06°00.05'	152°50.00'	5750
	15/10/97	end	18.05	05°59.97'	152°39.96'	6000
MES-16E	15/10/97	start	18.05	05°59.97'	152°39.96'	6000
	15/10/97	end	23.19	05°04.95'	152°39.96'	2080

SSW to NNE and E to W echosounder traverses to clarify gaps in the seafloor bathymetry and the structure of the New Britain Trench.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)
MES-26A	29/10/97	start	12.29	05°32.01'	153°52.94'	4704
	29/10/97	end	15.47	05°39.98'	153°17.61'	4350
MES-26B	29/10/97	start	15.47	05°39.98'	153°17.61'	4350
	29/10/97	end	19.21	06°10.17'	153°13.22'	5750
MES-26C	29/10/97	start	19.21	06°10.17'	153°13.22'	5750
	29/10/97	end	22.30	05°48.20	153°32.84'	5650
MES-26D	29/10/97	start	22.30	05°48.20'	153°32.84'	5650
	30/10/97	end	03.00	06°24.91'	153°24.03'	4889

Survey to profile the New Britain trench to further clarify its structure.

St George's Channel

Echosounder Profiles

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)
MES-17A	15/10/97	start	23.19	05°04.84'	153°39.77'	2080
	16/10/97	end	01.33	05°05.01'	153°14.98'	2645
MES-17B	16/10/97	start	01.33	05°05.01'	153°14.98'	2645
	16/10/97	end	02.51	05°15.10'	152°07.78'	1032
MES-17C	16/10/97	start	02.51	05°15.04'	152°07.78'	1032
	16/10/97	end	03.57	05°10.98'	152°03.28'	974
MES-17D	16/10/97	start	03.57	05°10.98'	152°03.28'	974
	16/10/97	end	05.28	05°00.00'	152°16.01'	1437
MES-17E	16/10/97	start	05.28	05°00.00'	152°16.01'	1437
	16/10/97	end	07.01	04°45.03'	152°25.97'	1056
MES-17F	16/10/97	start	07.01	04°45.03'	152°25.97'	1056

	16/10/97	end	08.10	04°30.50	152°26.08'	1750
MES-17G	16/10/97	start	08.27	04°29.89	152°23.34'	900
	16/10/97	end	08.44	04°27.87'	152°25.54'	1600
MES-17H	16/10/97	start	08.44	04°27.87'	152°25.54'	1600
	16/10/97	end	08.57	04°27.21'	152°23.93'	1000
MES-17J	16/10/97	start	08.57	04°27.21'	152°23.93'	1000
	16/10/97	end	09.12	04°25.13'	152°25.95'	1830
MES-17K	16/10/97	start	09.12	04°25.13'	152°25.95'	1830
	16/10/97	end	09.21	04°24.83'	152°25.76'	1000
MES-17L	16/10/97	start	09.21	04°24.83'	152°25.76'	1000
	16/10/97	end	09.35	04°22.74'	152°26.13'	1600
MES-17M	16/10/97	start	09.35	04°22.74'	152°26.13'	1600
	16/10/97	end	09.49	04°20.04'	152°26.03'	760

Variably oriented echosounder traverses approaching St. George's Channel to clarify geological structures including the Wide Bay Fault and the extension of the Djual Fault.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)
MES-18A	16/10/97	start	09.49	04°20.04'	152°26.03'	760
	16/10/97	end	10.33	04°19.91'	152°34.06'	1990
MES-18B	16/10/97	start	10.33	04°19.91'	152°34.06'	1990
	16/10/97	end	11.05	04°15.63'	152°39.30'	990
MES-18C	16/10/97	start	11.05	04°15.63'	152°39.30'	990
	16/10/97	end	11.40	04°09.90'	152°35.93'	1585
MES-18D	16/10/97	start	11.40	04°09.90'	152°35.93'	1585
	16/10/97	end	12.00	04°05.88'	152°33.02'	1718
MES-18E	16/10/97	start	12.00	04°05.88'	152°33.02'	1718
	16/10/97	end	12.16	04°04.03'	152°35.11'	1000
MES-18F	16/10/97	start	12.16	04°04.03'	152°35.11'	1000
	16/10/97	end	14.40	04°02.31'	152°30.90'	1999

Survey to infill gaps in the bathymetry and to clarify geological structures in St George's Channel, particularly the Weitin Fault.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)
MES-23A	27/10/97	start	13.15	04°02.55'	151°55.23'	789
	27/10/97	end	14.13	04°11.80'	151°51.55'	527
MES-23B	27/10/97	start	14.13	04°11.80'	151°51.55'	527
	27/10/97	end	14.57	04°05.03'	151°49.96'	664
MES-23C	27/10/97	start	14.57	04°05.03'	151°49.96'	664
	27/10/97	end	15.21	04°07.86'	151°48.23'	775
MES-23D	27/10/97	start	15.21	04°07.86'	151°48.23'	775
	27/10/97	end	16.17	03°59.89'	151°43.98'	1557
MES-23E	27/10/97	start	16.17	03°59.89'	151°43.98'	1557
	27/10/97	end	16.55	03°05.79'	151°41.24'	1241
MES-23F	27/10/97	start	16.56	03°05.79'	151°41.24'	1241
	27/10/97	end	17.54	03°59.99	151°50.01'	1147

Echosounder traverse to locate the Djual Fault where it intersects the coast of New Britain.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)
MES-24A	28/10/97	start	19.16	04°20.06'	152°'26.02'	795
	28/10/97	end	21.32	04°40.05'	152°33.78'	2771
MES-24B	28/10/97	start	21.32	04°40.05'	152°33.78'	2771
	28/10/97	end	23.18	04°57.56'	152°33.91'	3542
MES-24C	28/10/97	start	23.18	04°57.56'	152°33.91'	3542
	28/10/97	end	23.50	04°58.03'	152°39.97'	2206
MES-24D	28/10/97	start	23.50	04°58.03'	152°39.97'	2206
	28/10/97	end	06.45	05°30.45'	153°50.47'	1759

Survey to infill gaps in the bathymetry and to clarify geological structures in St. George's Channel and the seafloor south of New Ireland.

Dredges

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-109	25/10/97	in water	04.52	03°53.71'	151°46.43'	2087	0
		on bottom	05.16	03°53.66'	151°46.33'	2088	2081
		off bottom	06.07	03°53.93'	151°46.51'	1953	1955

Dredge to sample the lowest of three fault scarps defining the SW margin of the Eastern Manus Basin and to collect basement rocks.

Weitin Graben

Echosounder Profiles

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)
MES-19A	16/10/97	start	12.45	04°02.09'	152°30.42'	1967
	16/10/97	end	12.58	03°59.95'	152°30.40'	2010
MES-19B	16/10/97	start	13.03	04°00.88'	152°28.99'	1855
	16/10/97	end	13.25	04°00.74'	152°31.97'	2004

Echosounder traverse to locate the crest of the small volcano in the Weitin Graben in order to identify a target for dredge operations.

Hydrocasts

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	CTD pressure	Depth (m)	Wire-Out (m)
MH-49	16/10/97	CTD in water	14.43	04°01.66'	152°31.06'	0	nd	0
		sample 1	15.02	04°00.69'	152°30.64'	448	nd	nd
		sample 2	15.14	03°59.96'	152°30.38'	242	2013	392
		sample 3	15.21	03°59.52'	152°30.22'	5	2016	2.1
		CTD on deck	15.22	nd	nd	nd	nd	0

CTD-transmissometer tow-yo of three dips to test for hydrothermal activity proximal to the Weitin Volcano.

Dredges

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-104	24/10/97	in water	06:05	03°33.73'	151°55.68'	1896	0
		on bottom	06:29	03°33.79'	151°55.70'	1899	1941
		off bottom	07:18	03°34.03'	151°55.87'	1849	1841

Dredge to characterise a high ridge close to the Weitin Fault, and to test for the presence of basement rocks.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-105	24/10/97	in water	08.33	03°33.79'	151°55.74'	1893	-6
		on bottom	08.56	03°33.80'	151°55.74'	1893	1938
		off bottom	09.48	03°33.91'	151°55.73'	1875	1874

Dredge to characterise a high ridge close to the Weitin Fault, and to test for the presence of basement rocks.

Nimab

Echosounder Profiles

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)
MES-20A	16/10/97	start	22.19	03°50.33'	152°11.19'	1654
	16/10/97	end	22.38	03°48.36'	152°11.22'	1446
MES-20B	16/10/97	start	23.32	03°49.32'	152°10.10'	1694
	16/10/97	end	23.56	03°49.20'	152°12.30'	1766

Echosounder traverse to locate the position of the crest of the Nimab Volcano.

Hydrocasts

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	CTD pressure	Depth (m)	Wire-Out (m)
MH-51	17/10/97	CTD in water	11.33	3°49.79'	152°12.29'	0	1750	0
		sample 1	15.39	03°46.91'	152°16.09'	1700	2056	2006
		sample 2	15.54	03°46.74'	152°16.26'	1002	2049	1225

	sample 3	16.15	03°46.44'	152°16.45'	7	2042	-2
	CTD on deck	16.16	03°46.43'	152°16.46'	4	2043	-4

Hydrocast survey of the extent of the Nimab plume and the location of its source. MH-51 is a continuation of MH-50.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	CTD pressure	Depth (m)	Wire-Out (m)
MH-55	19/10/97	CTD in water	20.34	03°50.68'	152°06.62'	0	1730	0
		sample 1	00.23	03°47.23'	152°09.79'	1728	1704	2234
		sample 2	00.28	03°47.19'	152°09.82'	1614	1701	2060
		sample 3	00.33	03°47.12'	152°09.85'	1411	1698	1779
		sample 4	00.48	03°47.01'	152°10.02'	1185	1691	1447
		sample 5	00.57	03°46.93'	152°10.10'	1118	1689	1282
		sample 6	01.05	03°46.82'	152°10.22'	1000	1684	1144
		sample 7	01.05	03°46.82'	152°10.22'	1000	1684	1144
		sample 8	01.12	03°46.80'	152°10.32'	802	1680	925
		sample 9	01.20	03°46.72'	152°10.44'	504	1675	574
		sample 10	01.26	03°46.65'	152°10.51'	300	1674	329
		sample 11	01.33	03°46.58'	152°10.59'	7	1673	-3
		sample 12	02.33	03°46.27'	152°10.97'	1658	1472	1746
		sample 13	02.47	03°46.20'	152°11.18'	1009	1122	1077
		sample 14	03.07	03°46.12'	152°11.45'	7	1592	1
		CTD on deck	03.07	03°46.12'	152°11.45'	0	1592	0

Hydrocast survey between Susu and Nimab to relocate the Susu plume and test whether there are two plume sources, and also to complete a plume profile.

Grabs

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-23	17/10/97	on bottom	18.27	03°48.58'	152°12.78'	1806	1843

Sample of a reflective zone at the base of the SE face of Nimab marked by an extensional fault that strikes northeast to test if this is the source of the Nimab plume.

Sediment Cores

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MS-41	17/10/97	on bottom	20.31	03°49.61'	152°12.40	1775	1870

Sediment core under the Nimab plume to test for the presence of settled particulates.

Dredges

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-85	17/10/97	in water	00.25	03°49.17'	152°11.10'	1078	0
		on bottom	00.43	03°49.26'	152°11.21'	1038	1054
		off bottom	01.10	03°49.37'	152°11.37'	1087	1058

Dredge to sample possible hydrothermal deposits on the crest of Nimab.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-87	17/10/97	in water	21.52	03°52.97'	152°11.47'	1594	0
		on bottom	22.16	03°53.10'	152°11.40'	1507	1558
		off bottom	22.58	03°52.98'	152°11.49'	1525	1527

Sample and characterise the small volcano south of Nimab.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-88	18/10/97	in water	11.02	03°49.16'	152°11.23'	1047	0
		on bottom	11.16	03°49.22'	152°11.22'	1038	1004
		off bottom	11.49	03°49.39'	152°11.52'	1145	960

Sample hydrothermal deposits on the crest of Nimab Volcano that were photographed during MCV-41.

Camera Tows

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-41	18/10/97	in water	00.38	03°49.19'	152°11.27'	1040	0
		on bottom	01.10	03°49.20'	152°11.25'	nd	994
		off bottom	02.10	03°49.19'	152°11.26'	nd	992

Photo traverse across the crest of Nimab Volcano in search of altered volcanics and crusts dredged in MD-85.

Susu Knolls - Regional

Echosounder Profiles

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)
MES-22	24/10/97	start	20.28	03°49.14'	152°05.77'	1606
	24/10/97	end	21.06	03°53.76'	152°'02.75'	1841

Echosounder traverse to profile a small volcano south of Susu Knolls and aid placement of dredge MD-107.

Hydrocasts

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	CTD pressure	Depth (m)	Wire-Out (m)
MH-50	16/10/97	CTD in water	17.28	03°51.23'	152°10.00'	1	1696	0
		sample 1	21.11	03°49.52'	152°11.93'	1708	1728	1767
		sample 2	21.19	03°49.47'	152°12.00'	1350	1997	1400
		sample 3	21.22	03°49.47'	152°12.05'	1251	1655	1299
		sample 4	21.24	03°49.46'	152°12.06'	1201	1583	1241
		sample 5	21.26	03°49.44'	152°12.07'	1181	1566	1215
		sample 6	21.28	03°49.42'	152°12.08'	1141	1539	1168
		sample 7	21.28	03°49.42'	152°12.08'	1141	1539	1168
		sample 8	21.31	03°49.11'	152°12.10'	1128	1566	1153
		sample 9	21.32	03°49.40'	152°12.10'	1100	1509	1119
		sample 10	21.34	03°49.38'	152°12.10'	1051	1480	1067
		sample 11	21.53	03°49.29'	152°12.18'	7	2434	-2
		CTD on deck	21.55	03°49.29'	152°12.18'	nd	nd	0

To conduct a CTD-transmissometer tow-yo of many dips to test for the presence of a hydrothermal plume from Nimab Volcano, east of Susu. A negative result will close the Susu plume in this direction.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	CTD pressure	Depth (m)	Wire-Out (m)
MH-52	18/10/97	CTD in water	03.02	03°49.94'	152°08.81'	0	1782	0
		sample 1	09.36	03°46.74'	152°12.18'	1703	1717	1796

	sample 2	09.54	03°46.52'	152°12.30'	1000	1701	1105
	sample 3	10.16	03°46.14'	152°12.25'	7	1654	-6
	CTD on deck	10.18	03°46.09'	152°12.20'	4	1639	-15

Survey a line between the Susu and Nimab plumes to establish whether they are definitely from different sources.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	CTD pressure	Depth (m)	Wire-Out (m)
MH-56	20/10/97	CTD in water	23.37	03°48.40'	152°05.79'	nd	1542	0
		sample 1	03.34	03°45.24'	152°09.67'	1800	2104	1899
		sample 2	03.53	03°45.15'	152°09.87'	804	nd	847
		sample 3	04.08	03°45.01'	152°10.11'	7	1939	-3
		CTD at surface	04.08	03°45.01'	152°10.11'	7	1939	-3

To survey a line north eastwards from Susu to locate and map its plume.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	CTD pressure	Depth (m)	Wire-Out (m)
MH-61	28/10/97	CTD in water	09.41	03°49.49'	152°08.49'	1	1669	0
		sample 1	10.11	03°49.51'	152°08.49'	1683	1660	1685
		sample 2	10.14	03°49.49'	152°08.47'	1541	1666	1542
		sample 3	10.18	03°49.50'	152°08.49'	1401	1665	1401
		sample 4	10.22	03°49.50'	152°08.49'	1260	1665	1261
		sample 5	10.25	03°49.50'	152°08.49'	1125	1666	1124
		sample 6	10.27	03°49.47'	152°08.46'	1095	1669	1097
		sample 7	10.30	03°49.50'	152°08.49'	1091	1668	1090
		sample 8	10.32	03°49.49'	152°08.48'	1086	1668	1085
		sample 9	10.33	03°'49.49'	152°08.48'	1084	1669	1084
		sample 10	10.35	03°49.48'	152°08.49'	1070	1669	1069
		sample 11	10.39	03°49.49'	152°08.49'	900	1668	898
		CTD on deck	10.57	nd	nd	nd	nd	nd

To collect a profile of samples from an intermediate position within the Susu plume.

Dredges

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-89	18/10/97	in water	23.53	03°46.04'	152°04.17'	1775	0
		on bottom	00.19	03°46.11'	152°04.37'	1668	1744
		off bottom	01.05	03°46.32'	152°04.46'	1609	1571

To sample bedrock on a small knoll northwest of Susu Knolls.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-106	24/10/97	in water	14.45	03°43.76'	152°05.51'	1957	0
		on bottom	15.09	03°43.83'	152°05.63'	1936	1955
		off bottom	15.48	03°43.98'	152°05.95'	1902	1993

Dredge to sample a young lava field at the NW end of Tumai Ridge.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-107	24/10/97	in water	21.43	03°52.43'	152°03.75'	1755	3
		on bottom	22.13	03°52.54'	152°03.89'	1668	1750
		off bottom	22.59	03°52.46'	152°03.96'	1703	1686

Dredge to sample the small volcano south of Susu Knolls.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-108	25/10/97	in water	00.30	03°51.25'	152°00.27'	1933	0
		on bottom	01.04	03°51.36'	152°00.32'	1873	1914
		off bottom	01.59	03°51.53'	152°00.50'	1851	1844

Dredge to sample a small volcano on a transform-parallel scarp southwest of Susu.

Sediment Cores

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MS-43	19/10/97	on bottom	03.15	03°48.06'	152°01.91'	2092	2075

To collect sediment core from an enclosed basin west of Susu Knolls and test for a possible brine pool.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MS-44	20/10/97	on bottom	11.20	03°48.97'	152°08.21'	1743	1729

To collect core from an enclosed basin east of Susu Knolls and test for a possible brine pool.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MS-45	21/10/97	on bottom	05.30	03°48.99'	152°08.30'	1734	1744

To collect core from an enclosed basin east of Susu Knolls and test for a possible brine pool.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MS-49	24/10/97	on bottom	13.11	03°40.04'	152°05.51'	2122	2150

Sediment core to collect a sample from the basin north of Tumai Ridge.

Grabs

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-29	21/10/96	on bottom	12.42	03°49.03'	152°08.24'	1734	1742

Collection of sediment from an enclosed basin east of Susu Knolls since sediment corer attempts failed.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-31	21/10/97	on bottom	21.01	03°48.42'	152°07.13'	1660	1664

Collection of sediment sample to the east of MG-30 at the eastern foot of North Su.

South Su

Echosounder Profiles

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)
MES-21	24/10/97	start	17.00	03°47.03'	152°05.74'	1564
	24/10/97	end	17.27	03°49.11'	152°'06.35'	1530

Echosounder traverse to listen for acoustic emission from North and South Su and to locate the apparent crest and depth of both peaks.

Hydrocasts

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	CTD pressure	Depth (m)	Wire-Out (m)
MH-53	18/10/97	CTD in water	21.18	03°49.29'	152°06.25'	0	1646	0
		sample 1	21.47	03°49.28'	152°06.32'	1654	1631	1654
		sample 2	21.52	03°49.22'	152°06.27'	1500	1606	1507
		sample 3	21.56	03°49.25'	152°06.32'	1464	1640	1462
		sample 4	21.59	03°49.21'	152°06.28'	1444	1768	1448
		sample 5	22.04	03°49.21'	152°06.30'	1388	1631	1393
		sample 6	22.09	03°49.17'	152°06.29'	1337	1545	1338
		sample 7	22.15	03°49.19'	152°06.32'	1203	1620	1200
		sample 8	22.20	03°49.19'	152°06.35'	1109	1549	1107
		sample 9	22.24	03°49.16'	152°06.35'	1076	1542	1074
		sample 10	22.28	03°49.17'	152°06.37'	1041	1579	1038
		sample 11	22.33	03°49.17'	152°06.39'	1001	1489	997
		sample 12	22.40	03°49.19'	152°06.41'	750	1351	744
		sample 13	22.48	03°49.21'	152°06.44'	500	1216	494
		sample 14	22.55	03°49.16'	152°06.39'	250	1079	244
		sample 15	23.03	03°49.13'	152°06.36'	6	1525	-5
		CTD on deck	23.03	03°49.13'	152°06.36'	nd	nd	nd

To collect water samples in the upper and lower Susu plumes at the same site as MH-45 (PACMANUS-III) and to check the variation between 1996-1997 and provide a representative suite of filtered particulates. Also to check the pH profile found in MH-50.

Dredges

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-91	19/10/97	in water	17.10	03°48.55'	152°06.26'	1322	0
		on bottom	17.26	03°48.59'	152°06.27'	1323	1326
		off bottom	17.51	03°48.90'	152°06.62'	1495	1343

Dredge to sample hydrothermal deposits on the crest of South Su photographed by MCV-42 (19:30-19:33 h).

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-92	20/10/97	in water	08.31	03°48.47'	152°06.20'	1332	-5
		on bottom	08.48	03°48.46'	152°06.19'	1340	1373
		off bottom	09.31	03°48.48'	152°06.16'	1337	1350

To sample a group of hydrothermal deposits on the crest of South Su, photographed during MCV-42 (19:10 -19:15 h).

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-93	20/10/97	in water	12.41	03°48.43'	152°06.65'	1509	2
		on bottom	12.58	03°48.47'	152°06.60'	1434	1519
		off bottom	13.31	03°48.78'	152°06.96'	1632	1595

To sample a group of hydrothermal deposits on the crest of South Su, photographed during MCV-42 (18:52 -19:01 h).

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-95	20/10/97	in water	20.02	03°48.57'	152°06.29'	1331	-6
		on bottom	20.17	03°48.54'	152°06.27'	1327	1320
		off bottom	20.48	03°48.81'	152°06.44'	1449	1403

Repeat of MD-91 to sample hydrothermal deposits on the crest of South Su, photographed during MCV-42 (19:30 - 19:33 h).

Camera Tows

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-42	18/10/97	in water	18.02	03°48.48'	152°06.17'	1339	0
		on bottom	18.50	03°48.44'	152°06.20'	nd	1375
		off bottom	19.47	03°48.66'	152°06.38'	nd	1383

Photo traverse across the crest of South Su.

North Su

Hydrocasts

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	CTD pressure	Depth (m)	Wire-Out (m)
MH-57	21/10/97	CTD in water	08.06	03°48.09'	152°06.51'	0.8	1540	0
		sample 1	08.45	03°48.03'	152°06.52'	1500	1552	1500
		sample 2	08.48	03°48.02'	152°06.52'	1399	1564	1399
		sample 3	08.52	03°48.00'	152°06.50'	1310	1522	1309
		sample 4	08.57	03°48.07'	152°06.50'	1200	1524	1206
		sample 5	09.00	03°48.08'	152°06.49'	1186	1515	1189
		sample 6	09.01	03°48.08'	152°06.48'	1168	1504	1169
		sample 7	09.03	03°48.08'	152°06.47'	1151	1492	1151
		sample 8	09.04	03°48.07'	152°06.47'	1134	1423	1132
		sample 9	09.06	03°48.07'	152°06.47'	1117	1554	1115
		sample 10	09.08	03°48.07'	152°06.48'	1107	1462	1105
		sample 11	09.11	03°48.06'	152°06.48'	1001	1504	997
		CTD on deck	09.30	nd	nd	nd	nd	nd

To collect a profile of samples from an intense part of the Susu plume.

Dredges

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-96	21/10/97	in water	09.49	03°47.94'	152°06.02'	1177	0
		on bottom	10.04	03°47.94'	152°06.07'	1175	1240
		off bottom	10.47	03°47.98'	152°06.05'	1167	1133

Dredge to sample hydrothermal deposits on the crest of North Su, photographed at the start of MCV-45.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-97	21/10/97	in water	18.44	03°47.97'	152°06.05'	1168	4
		on bottom	18.58	03°47.98'	152°06.04'	1170.3	1200
		off bottom	19.26	03°48.30'	152°06.38'	1443	1341

Dredge to sample hydrothermal deposits on the crest of North Su, photographed soon after the start of MCV-45. The site is approximately 60 metres from MD-96.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-116	28/10/97	in water	07.53	03°48.01'	152°06.08'	1174	-1
		on bottom	08.08	03°48.01'	152°06.07'	1174	1160
		off bottom	08.37	03°48.10'	152°06.19'	1258	1140

Dredge to sample hydrothermal deposits located by MCV-51 on the crest of North Su.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-117	28/10/97	in water	13.58	03°48.01'	152°06.04'	1172	-4
		on bottom	14.11	03°47.99'	152°06.04'	1176	1173
		off bottom	14.36	03°48.18'	152°06.26'	1343	1252

Dredge to sample the chimney field located by MCV-45 on the crest of North Su.

Camera Tows

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-45	20/10/97	in water	17.35	03°47.94'	152°06.02'	1188	0
		on bottom	18.11	03°47.96'	152°06.02'	nd	1183
		off bottom	19.13	03°48.13'	152°06.04'	nd	1256

To photo traverse across the crest of North Su.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-51	24/10/97	in water	18.00	03°47.89'	152°06.06'	1190	0
		on bottom	18.37	03°47.92'	152°06.07	nd	1254
		off bottom	19.37	03°48.08'	152°06.12	nd	1222

A second camera photo traverse across the crest of North Su, 200m east of MCV-45.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-54	28/10/97	in water	11.36	03°48.00'	152°06.05'	1167	0
		on bottom	12.12	03°47.95'	152°06.07'	nd	1164
		off bottom	13.12	03°48.17'	152°06.10'	nd	1248

A third camera photo traverse across the crest of North Su, between MCV-45 and MCV-50 trying to close off the field to the southeast.

Grabs

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-30	21/10/97	on bottom	17.32	03°47.66'	152°06.43'	1518	1727

Collection of sediment from an enclosed basin east of Susu Knolls since corer attempts have failed.

Suzette

Dredges

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-86	17/10/97	in water	08.42	03°47.02'	152°05.44'	1388	0
		on bottom	09.02	03°47.06'	152°05.43'	1588	1500
		off bottom	09.38	03°47.07'	152°05.53'	1569	1429

To sample the volcanic outcrops northwest of Suzette.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-94	20/10/97	in water	15.08	03°47.34'	152°05.62'	1519	-4
		on bottom	15.24	03°47.36'	152°05.62'	1534	1510
		off bottom	15.59	03°47.59'	152°05.90'	1480	1550

To sample chimneys from the central Suzette field.

Sediment Cores

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MS-40	17/10/97	on bottom	07.01	03°47.36'	152°05.69'	1524	1489

To sample sediments from a site near Suzette chimney field to test for the presence of plume particulates.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MS-42	18/10/97	on bottom	14.12	03°47.42'	152°05.70'	1530	1470

To sample sediments from a site near Suzette chimney field to test for the presence of plume particulates.

Grabs

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-24	19/10/97	on bottom	09.59	03°47.36'	152°05.65'	1517	1517

To collect a sediment sample from close to the Suzette chimney field to test for the dispersion of plume particulates.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-25	19/10/97	on bottom	14.17	03°47.21'	152°05.71'	1524	1518

To collect a sediment sample from close to the Suzette chimney field to test for the dispersion of plume particulates.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-25R	19/10/97	on bottom	15. 32	03°47.19'	152°05.67'	1520	1520

Repeat of operation MG-25.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-26	19/10/97	on bottom	19.24	03°47.37'	152°05.86'	1528	1562

Collection of sediment from close to the Suzette chimney field to test for the dispersion of plume particulates.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-27	20/10/97	on bottom	22.19	03°47.38'	152°06.06'	1605	1627

Collection of a sediment sample from east of the Suzette chimney field to test the dispersion of plume particulates.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-28	21/10/97	on bottom	06.52	03°46.87'	152°06.44'	1683	1680

To collect a sediment sample on the east flank of Suzette, another point in the grid to test the dispersion of plume particulates.

Camera Tows

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-40	17/10/97	in water	02.48	03°47.13'	152°05.66'	nd	0
		on bottom	03.24	03°47.20'	152°05.73'	nd	1495
		off bottom	04.20	3°47.20'	152°05.80'	nd	1516

Photo traverse across the presumed line of chimneys at Suzette and to confirm from the SDL logging that the chimneys are active and form a mound.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-43	19/10/97	in water	11.07	03°47.33'	152°05.67'	1509	0
		on bottom	11.50	03°47.32'	152°05.71'	nd	1503
		off bottom	12.51	03°47.44'	152°05.58'	nd	1497

Photo traverse across the line of chimneys at Suzette and to confirm from the SDL readings that these are active and form a mound.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-44	20/10/97	in water	04.25	03°47.17'	152°05.59'	1523	0
		on bottom	05.02	03°47.16'	152°05.70'	nd	1575
		off bottom	06.57	03°47.82'	152°06.17'	nd	1505

Photo traverse across the line of chimneys at Suzette, continuing along the flank to the col between Suzette and North Su.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-46	21/10/97	in water	14.25	03°47.38'	152°05.72'	1505	0.0
		on bottom	14.57	03°47.38'	152°05.75'	nd	1502
		off bottom	15.59	03°47.54'	152°05.62'	nd	1543

Photo traverse across the possible southern extension of the Suzette hydrothermal field.

Tumbo

Hydrocasts

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	CTD pressure	Depth (m)	Wire-Out (m)
MH-54	19/10/97	CTD in water	07.14	03°46.95'	152°00.96'	0	2050	0
		sample 1	07.52	03°46.77'	152°01.45'	1999	2044	2073
		sample 2	08.13	03°46.65'	152°01.62'	1001	2079	1031
		sample 3	08.32	03°46.48'	152°01.66'	12	1488	7
		CTD on deck	08.34	03°46.44'	152°01.65'	nd	nd	nd

Survey of a northeast trending line southeast of Tumbo to establish whether a plume exists.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	CTD pressure	Depth (m)	Wire-Out (m)
MH-60	28/10/97	CTD in water	03.39	03°48.59'	151°59.99'	1	2026	0
		sample 1	05.40	03°47.29'	152°01.69'	2050	2084	2443
		sample 2	06.01	03°47.08'	152°02.11'	1003	2091	1356
		sample 3	06.27	03°46.86'	152°02.26'	6	2090	-2
		CTD on deck	06.27	03°46.86'	152°02.26'	nd	nd	nd

Test for the presence of hydrothermal activity on Tumbo Knolls, chasing the 0.6% anomaly of MH-54.

Dredges

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-90	19/10/97	in water	05.05	03°46.00'	152°00.46'	1733	0
		on bottom	05.40	03°46.14'	152°00.49'	1716	1848
		off bottom	06.18	03°46.25'	152°00.69'	1668	1643

To sample the Tumbo Volcano.

Umbo Knolls

Hydrocasts

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	CTD pressure	Depth (m)	Wire-Out (m)
MH-59	27/10/97	CTD in water	19.36	03°46.20'	151°54.31'	9	2025	2
		sample 1	22.20	03°43.49'	151°56.75'	2151	2155	2845
		sample 2	22.28	03°'43.33'	151°56.84'	1800	2150	2511
		sample 3	22.33	03°'43.22'	151°56.90'	1578	2155	2275
		sample 4	22.38	03°43.11'	151°56.94'	1403	2146	2064
		sample 5	22.44	03°42.95'	151°57.01'	1204	2157	1816
		sample 6	22.47	03°42.89'	151°57.05'	1161	2156	1754
		sample 7	22.49	03°42.86'	151°57.06'	1161	2156	1747
		sample 8	22.53	03°42.76'	151°57.15'	1002	2155	1565
		sample 9	23.05	03°42.48'	151°57.25'	607	1987	950
		sample 10	23.16	03°42.30'	151°57.37'	308	2145	425
		sample 11	23.24	03°42.10'	151°57.44'	6	2146	-2
		CTD on deck	23.28	03°42.03'	151°57.37'	5	2149	-8

To test for the presence of hydrothermal activity on Umbo Knolls.

Dredges

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-115	28/10/97	in water	00.30	03°43.25'	151°53.77'	1554	0
		on bottom	00.49	03°43.19'	151°53.74'	1574	1645
		off bottom	01.30	03°43.47'	151°53.96'	1526	1562

Dredge to characterise the higher, western peak of Umbo Knolls.

Pual Ridge regional

Dredges

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-99	22/10/97	in water	08.11	03°42.57'	151°41.45'	1664	3
		on bottom	08.29	03°42.56'	151°41.44'	1661	1650
		off bottom	09.09	03°42.74'	151°41.44'	1683	1618

Dredge to sample the crest of Sonne Pimple.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-101	23/10/97	in water	05.39	03°40.98'	151°33.27'	1643	0
		on bottom	06.00	03°41.02'	151°33.27'	1635	1725
		off bottom	06.47	03°41.31'	151°33.60'	1715	1690

Dredge to characterise a high ridge on the western side of Marmin Knolls.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	CTD pressure	Depth (m)	Wire-Out (m)
MH-58	23/10/97	CTD in water	01.02	03°43.59'	151°30.29'	0	2525	0
		sample 1	01.50	03°43.57'	151°30.21'	2528	2520	2532
		sample 2	01.54	03°43.56'	151°30.19'	2380	2520	2384
		sample 3	01.58	03°43.53'	151°30.28'	2231	2523	2233
		sample 4	02.02	03°43.55'	151°30.21'	2081	2524	2083
		sample 5	02.05	03°43.51'	151°30.18'	1930	2514	1937
		sample 6	02.09	03°43.46'	151°30.14'	1778	2523	1797
		sample 7	02.13	03°43.45'	151°30.16'	1632	2298	1643
		sample 8	02.17	03°43.49'	151°30.23'	1481	2208	1488
		sample 9	02.21	03°43.43'	151°30.23'	1331	2128	1333
		sample 10	02.24	03°43.47'	151°30.25'	1181	2044	1181
		sample 11	02.28	03°43.42'	151°30.22'	1029	1967	1034
		CTD on deck	02.47	03°43.41'	151°30.24'	7	1472	0

Hydrocast to test for a possible brine pool near the bottom of a small enclosed basin. Collection of a profile of samples for pH measurements and chemistry.

Sediment Cores

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MS-46	23/10/97	on bottom	03.00	03°43.55'	151°30.17'	2524	2545

To collect a core from the enclosed basin tested by MH-58.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MS-47	24/10/97	on bottom	01.07	03°36.30'	151°46.42'	2005	2086

Sediment core from an enclosed basin along strike from Pual Ridge.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MS-48	24/10/97	on bottom	03.30	03°33.98'	151°48.97'	2008	1988

Sediment core to test a large basin approaching the Weitin Transform Fault.

Camera Tows

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-47	22/10/97	in water	03.24	03°42.56'	151°41.42'	1672	0
		on bottom	04.06	03°42.42'	151°41.42'	nd	1648
		off bottom	05.07	03°42.62'	151°41.50'	nd	1682

Photo traverse across the crest of Sonne Pimple looking for hydrothermal activity.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-48	22/10/97	in water	16.54	03°43.36'	151°41.35'	1760	0
		on bottom	17.29	03°43.30'	151°41.36'	nd	1748
		off bottom	19.25	03°42.90'	151°42.00'	nd	1787

Photo traverse across a small eruptive centre on the flank of Pual Ridge near PACMANUS. Previous dredges (PACMANUS-III) yielded Fe-stained dacite and fauna suggestive of hydrothermal activity.

PACMANUS

Dredges

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-98	22/10/97	in water	00.49	03°43.16'	151°40.56'	1690	0
		on bottom	01.08	03°43.19'	151°40.58'	1687	1671
		off bottom	01.52	03°43.46'	151°40.77'	1697	1665

To sample chimneys from Roger's Ruins hydrothermal field. The field was photographed and temperature anomalies observed by MCV-26 (PACMANUS-III).

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-100	22/10/97	in water	14.24	03°43.26'	151°40.50'	1694	-4
		on bottom	14.43	03°43.28'	151°40.53'	1697	1687
		off bottom	15.14	03°43.55'	151°40.59'	1725	1693

Dredge to sample chimneys at the southern end of the Roman Ruins hydrothermal field.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-102	23/10/97	in water	08.59	03°43.27'	151°40.51'	1690	-4
		on bottom	09.18	03°43.27'	151°40.47'	1693	1670
		off bottom	09.56	03°43.31'	151°40.49'	1694	1634

Second attempt to dredge chimneys at the southern end of the Roman Ruins hydrothermal field.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-103	23/10/97	in water	17.04	03°43.81'	151°40.02'	1676	-3
		on bottom	17.24	03°43.75'	151°40.01'	1666	1653
		off bottom	18.21	03°43.83'	151°40.13'	1679	1646

Sample chimney field located by *Shinkai-6500* in 1996.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-110	25/10/97	in water	09.05	03°43.75'	151°39.85'	1650	0
		on bottom	09.23	03°43.76'	151°39.84'	1670.5	1655
		off bottom	09.59	03°43.91'	151°40.02'	1665	1601

Dredge to sample chimney field photographed by MCV-50.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-111	25/10/97	in water	23.25	03°43.72'	151°39.99'	1648	0
		on bottom	23.43	03°43.68'	151°39.99'	1640	1639
		off bottom	00.17	03°43.97'	151°40.20'	1696	1731

Second attempt to dredge and sample chimney field photographed by MCV-50.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-112	26/10/97	in water	02.03	03°43.28'	151°40.49'	1683	16
		on bottom	02.21	03°43.26'	151°40.48'	1691	1674
		off bottom	04.49	03°43.29'	151°40.56'	1705	1649

Third attempt to sample sulfide chimneys at the southern part of Roman Ruins field.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-113	26/10/97	in water	20.46	03°43.16'	151°40.46'	1620	2
		on bottom	21.06	03°43.15'	151°40.45'	1657	1703
		off bottom	22.13	03°43.34'	151°40.52'	1620	1618

Second attempt to sample chimneys at the Roger's Ruins field.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-114	27/10/97	in water	02.44	03°43.78'	151°39.99'	1663	-1
		on bottom	03.04	03°43.77'	151°40.02'	1669	1665
		off bottom	04.01	03°43.74'	151°40.20'	1650	1656

Third attempt to sample sulfide chimneys in the field located by MCV-50.

VUNL Samples

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MV-01	25/10/97	in water	11.08	03°43.68'	151°40.23'	1650	0
		off bottom	16.31	03°43.66'	151°40.20'	1647	1693

To collect a sample of vent fluid from diffusely venting low temperature site at Snowcap (no bottle fired).

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MV-02	26/10/97	in water	09.46	03°43.68'	151°40.26'	1656	0
		bottle fired	13.02	03°43.67'	151°40.25'	1650	1690
		off bottom	13.04	03°43.66'	151°40.23'	1650	1687

To collect a sample of vent fluid from diffusely venting low temperature site at Snowcap.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MV-03	26/10/97	in water	14.13	03°43.67'	151°40.24'	1650	-9
		bottle fired	18.13	03°43.66'	151°40.23'	1652	1646
		off bottom	18.32	03°43.66'	151°40.25'	1651	1647

To collect a sample of vent fluid from diffusely venting low temperature site at Snowcap.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MV-04	27/10/97	in water	04.59	03°43.68'	151°40.25'	1652	0
		bottle fired	07.41	03°43.71'	151°40.23'	1652	1685
		off bottom	08.00	03°43.71'	151°40.24'	1653	1686

To collect a sample of vent fluid from diffusely venting low temperature site at Snowcap.

Hydrocasts

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-49	23/10/97	in water	14.06	03°43.30'	151°40.44'	1685	0
		on bottom	14.41	03°43.27'	151°40.49'	nd	1676
		off bottom	15.42	03°43.07'	151°40.70'	nd	1666

Photo traverse across an unexplored portion of the Roman Ruins hydrothermal field.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-50	23/10/97	in water	19.56	03°43.81'	151°39.97'	1664	0
		on bottom	20.31	03°43.81'	151°39.96'	nd	1643
		off bottom	22.36	03°43.43'	151°40.41'	nd	1661

Photo traverse across an unexplored portion of the crest of Pual Ridge.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-52	25/10/97	in water	19.29	03°43.81'	151°39.93'	1638	0
		on bottom	20.06	03°43.79'	151°39.93'	nd	1649
		off bottom	22.08	03°43.43'	151°40.39'	nd	1650

Photo traverse across an unexplored portion of the crest of Pual Ridge and parallel to and 50m west of MCV-50.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MCV-53	26/10/97	in water	06.45	03°43.22'	151°40.44'	1694	0
		on bottom	07.22	03°43.20'	151°40.44'	nd	1685
		off bottom	08.22	03°43.40'	151°40.66'	nd	1690

Photo traverse across the southern end of Roman Ruins chimney field.

Grabs

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-32	22/10/97	on bottom	06.51	03°43.72'	151°39.88'	1672	1668

To collect Fe-Mn-Si oxide hydrothermal deposits seen from the *Shinkai-6500* submersible.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-33	22/10/97	on bottom	10.46	03°43.75'	151°40.10'	1659	1661

To collect Fe-Mn-Si oxide hydrothermal deposits seen from *Shinkai-6500* submersible - second site.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-33R	22/10/97	on bottom	12.04	03°43.72'	151°40.09'	1659	1664

Repeat of MG-33 to collect Fe-Mn-Si oxide hydrothermal deposits seen from *Shinkai-6500* submersible.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-33RR	22/10/97	on bottom	13.26	03°43.75'	151°40.11'	1657	1670

Repeat of MG-33 and MG-33R to collect Fe-Mn-Si oxide hydrothermal deposits seen from *Shinkai-6500* submersible.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-34	22/10/97	on bottom	21.01	03°43.72'	151°40.09'	1660	1665

To collect Fe-Mn-Si oxide hydrothermal deposit seen from *Shinkai-6500* submersible - second site.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-34R	22/10/97	on bottom	22.46	03°43.72'	151°40.11'	1652	1656

Repeat of MG-34 to collect Fe-Mn-Si oxide hydrothermal deposit seen from *Shinkai-6500* submersible.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MG-35	23/10/97	on bottom	12.42	03°43.80'	151°39.90'	1688	1679

To collect Fe-Mn-Si oxide hydrothermal deposits seen from *Shinkai-6500* submersible.

Bougainville

Echosounder Profiles

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)
MES-25A	29/10/97	start	06.57	05°31.31'	153°52.21'	1556
	29/10/97	end	07.23	05°31.32'	153°56.59'	1244

MES-25B	29/10/97	start	07.43	05°29.59'	153°54.30'	1458
	29/10/97	end	08.15	05°33.07'	153°54.02'	1450

Echosounder profile to locate the crest of a recently re-discovered seamount between New Ireland and Bougainville.

Dredges

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-118	29/10/97	in water	08.56	05°31.40'	153°54.08'	680	0
		on bottom	09.06	05°31.48'	153°54.09'	612	770
		off bottom	09.54	05°31.42'	153°54.08'	657	742

Dredge to characterise a seamount east of Bougainville.

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
MD-119	29/10/97	in water	10.49	05°30.98'	153°54.06'	1114	1
		on bottom	11.04	05°31.03'	153°54.13'	1080	1207
		off bottom	11.40	05°31.11'	153°54.27'	998	1232

Second dredge to collect deeper rocks from the volcanic pediment and to characterise the seamount as arc or forearc.

Misima

Dredges

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
D-46	31/10/97	in water	05.17	10°34.61'	153°42.33'	2100	5
		on bottom	05.42	10°34.61'	153°42.33'	2050	2045
		off bottom	07.16	10°34.62'	153°42.66'	1729	1708

Dredge to characterise the northeastern seamount of the Misima cluster.

Echosounder Runs

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)
ES-50A	31/10/97	start	03.09	10°32.59'	153°43.77'	2175
	31/10/97	end	03.39	10°37.61'	153°43.79'	2525

ES-50B	31/10/97	start	03.39	10°37.61'	153°43.79'	2525
	31/10/97	end	04.05	10°34.71'	153°41.80'	2218
ES-50C	31/10/97	start	04.05	10°34.71'	153°41.80'	2218
	31/10/97	end	04.30	10°34.69'	153°45.80'	2345

Echosounder profile to locate the crest of a northeastern seamount in the Misima cluster.

Grabs

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	Depth (m)	Wire-Out (m)
G-3	31/10/97	on bottom	15.14	10°44.09'	152°50.93'	1370	nd

Grab operation to collect sediment sample from the basin used by Misima Mines for tailings disposal.

Hydrocasts

Operation	Date	Event	Time	Latitude (S)	Longitude (E)	CTD pressure	Depth (m)	Wire-Out (m)
H-36	31/10/97	CTD in water	08.12	10°34.69'	153°42.27'	2	2033	0
		sample 1	09.49	10°34.62'	153°43.66'	1625	1525	1798
		sample 2	10.05	10°34.58'	153°43.89'	996	1530	1116
		sample 3	10.27	10°34.38'	153°43.92'	10	1590	2
		CTD on deck	10.28	nd	nd	nd	nd	nd

Hydrocast to test for the presence of hydrothermal activity on the northeastern seamount of the Misima cluster.