double sided printing

December 10, 1987

Dr. Gary Brewer
Minerals Management Service
Pacific OCS Office
1340 West Sixth Street
Los Angeles, CA 90017

Re: MMS Contract No. 14-12-0001-30262

Dear Gary:

Enclosed please find a copy of the Cruise Report for MMS Cruise CAMP 2-3, Legs 1, 2, and 3. I have distributed copies of the this document to Principal Investigators, Quality Review Board Members, and oil company representatives.

Sincerely,

Jeffrey L. Hyland

Jeffrey L. Hyland, Ph.D.
Program Manager

JLH/hms

Enclosure

cc: Ms. Frances Sullivan, MMS Contracting Officer
(MS 635, Herndon, VA)

Dr. Donald Aurand, Chief of Environmental Studies Program
(MS 644, Washington, D.C.)

# CRUISE REPORT

FOR

MMS CRUISE CAMP 2-3

LEG 1, LEG 2, and LEG 3

December 10, 1987

CALIFORNIA OCS PHASE II MONITORING PROGRAM

Performed for

U. S. Department of the Interior
MINERALS MANAGEMENT SERVICE
Pacific OCS Office

1340 West Sixth Street
Los Angeles, California 90017

by

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Ocean Sciences and Technology Department
Ventura Office
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# 1.0 INTRODUCTION

CRUISE REPORT
FOR
MMS CRUISE CAMP 2-3
19 October 1987 - 12 November 1987

## 1.0 INTRODUCTION

Cruise CAMP 2-3 is the third of five cruises scheduled for Year Two of the MMS California Phase II Monitoring Program (MMS Contract No. 14-12-0001-30262). This program is designed to monitor potential environmental changes at a series of regional stations and at two arrays of site-specific stations near oil production platforms in the Western Santa Barbara Channel and Santa Maria Basin region of the California OCS. Platform Hidalgo (Lease P-0450) off Point Arguello was selected for hard-bottom, site-specific monitoring, and Platform Julius (Lease P-0409) off Point Sal was selected for soft-bottom, site-specific monitoring. Specific objectives of the program are:

1. To detect and measure potential long-term (or short-term) changes in the marine environment adjacent to oil and gas platforms; and

2. To determine whether changes observed in the marine environment during the monitoring period are caused by drilling-related activities or are a product of natural processes.

To accomplish these objectives, we are looking closely for potential biological changes and concomitant chemical or physical changes that can be linked to specific drilling events. An overall objective of Cruise CAMP 2-3 was to provide critical pre-drilling baseline data to help make these kinds of correlations and inferences.

Cruise CAMP 2-3 consisted of three legs. Leg 1 was devoted to the Soft-Bottom Sampling Task. The soft-bottom sampling consisted of box core sample collections at 28 sites for various biology, chemistry, and sedimentology parameters; hydrocasts at nine regional stations for dissolved oxygen, salinity, and temperature parameters; and deployment of animal traps for hydrocarbon and trace-metal tissue analysis.

Leg 2 was devoted to the Sediment-Transport Instrument-Retrieval Task. The objective of this leg was to continue recovery attempts of the current-meter mooring at Station R-9.

Leg 3 was devoted to the Physical Oceanography and Hard-Bottom Survey Tasks. The major objectives of Leg 3 were to perform photographic surveys at hard-bottom sites; service satellite telemetry systems and current meters at the Hidalgo and Julius study areas; perform hydrographic profiles at selected stations; deploy animal traps for hydrocarbon and trace metal tissue analysis; and collect three replicate grab samples at nine hard-bottom locations for various chemistry and sedimentology parameters.

International Underwater Contractor's (IUC) M/V Aloha was the support vessel for Cruise CAMP 2-3, Legs 1, 2, and 3. The M/V Aloha was mobilized in Ventura Harbor on 19 October 1987 for Leg 1 and returned on 28 October 1987. The M/V Aloha departed Ventura Harbor on 1 November 1987 for Leg 2. Leg 2 was

terminated  terminated and Leg 3 commenced in Port San Luis on 3 November 1987. Leg 3 returned to Ventura Harbor on 11 November 1987.

The reports of the consecutive cruise legs are provided in the sections below. The Soft-Bottom Leg 1 Cruise Report, written by Mr. James Campbell, is presented in Section 2.0; the Sediment-Transport Instrument-Retrieval Leg 2 Cruise Report, written by Dr. Brad Butman, is in Section 3.0; and the Physical Oceanography/Hard-Bottom Survey Leg 3 Cruise Report, written by Mr. Dane Hardin, is in Section 4.0. The study area is shown in Figure 1-1.

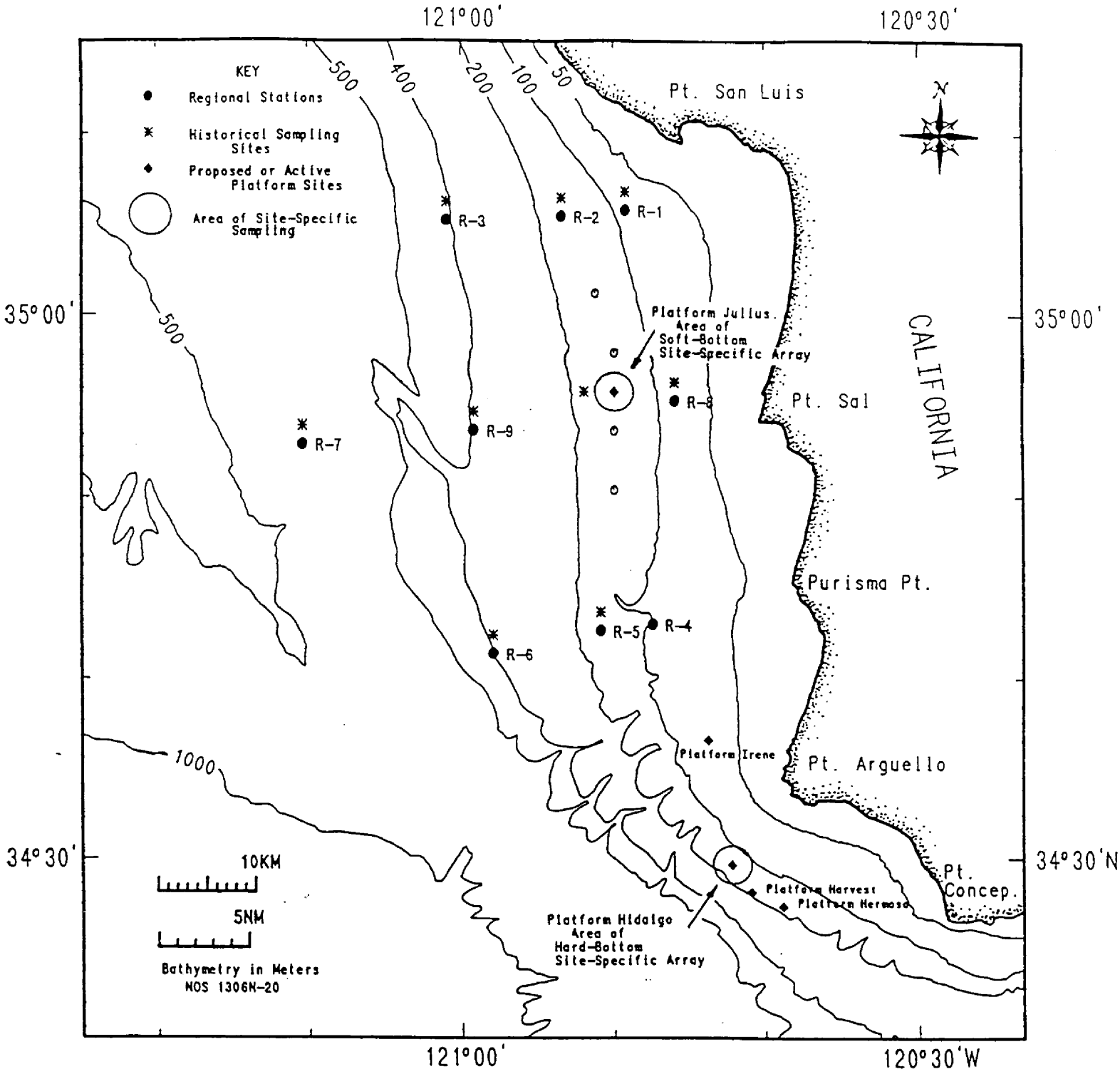



Figure 1-1. Area of Study and Staion Locations for MMS California OCS Phase II Monitoring Program

# 2.0 SOFT-BOTTOM CRUISE - LEG 1 REPORT

# 2.0 SOFT-BOTTOM CRUISE - LEG 1 REPORT
19 - 29 October 1987

## 2.1 Objectives

The objectives of the Soft-Bottom Leg were to collect three replicate box cores at nine regional stations and 19 site-specific stations. Each box core was to be sampled for benthic infauna (macrofauna and meiofauna), sediment chemistry, and sedimentology parameters. Four primary site-specific stations were to be sampled in triplicate for sediment pore-water chemistry. A string of three replicate animal traps was to be deployed at each of three selected stations (R-2, PJ-1 and PJ-11) for the collection of hydrocarbon and trace-metal tissue samples. A single hydrocast was to be performed at each of the nine regional stations for near-bottom measurements of dissolved oxygen, salinity, and temperature.

## 2.2 Results

International Underwater Contractor's M/V Aloha departed Ventura Harbor on Tuesday 20 October 1987 at 0015 hours. The cruise track and study area are shown in Figures 2-1 and 2-2. Good weather conditions and familiarity with sampling operations on the part of the scientific and ship's crew resulted in the early completion of all objectives. Mild wind and sea conditions combined with occasional rain prevailed throughout the cruise.

Sampling operations commenced at 1400 hours on 20 October 1987 and proceeded without major interruptions on a 24-hour schedule until 0800 on 28 October 1987.

Some problems were encountered with the main coring winch such as loose wraps on the winch drum and hydraulic fluid leaks from hose connections. During the recovery of the third box core, the winch wire developed numerous loose wraps, which presented a potential hazard to personnel safety and equipment. Over a period of four hours, the wire was untangled by hand and a makeshift level wind unit was rigged for the winch. The lack of a level wind unit has been addressed in the past and steps have been taken to rectify the situation for future cruises. On several occasions, the aft deck was washed down with soap and water to rid the sampling area of oil contamination. After several wash-downs, hydraulic hose fittings were replaced to alleviate the problem. A summary of samples collected is shown in Table 2-1.

## 2.3 Navigation

The Northstar 7000 LORAN-C receiver was the primary navigational aid for Cruise CAMP 2-3. A navigation software package developed by Mr. Andy Eliason of Eliason Data Services was used to integrate an Apple IIe microcomputer and Epson printer with the LORAN. The navigation data recorder logged time, date, latitude/longitude, LORAN time delays, samples collected, and general comments. The ship's position was displayed digitally on a monitor, while simultaneously recording on disk and printout. The system provided information on the ship's real-time position as well as navigation tracks to and from various waypoints.

All LORAN time delays were in the 9940 Group Repetition Interval (GRI) using the X and Y secondary stations, the 27-K and 41-K lines, respectively. All station navigation was based on LORAN time delays established in conjunction with the

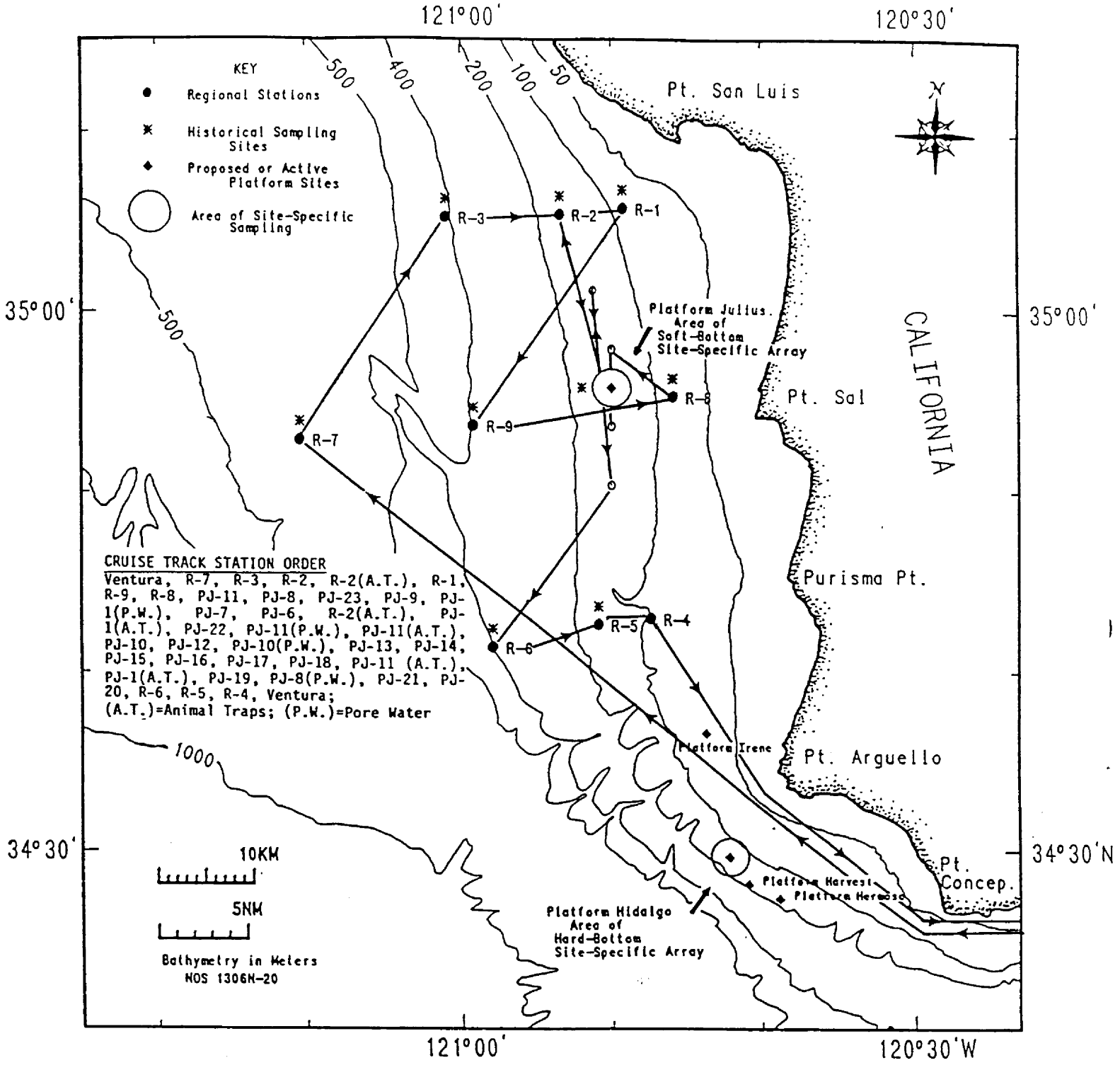



Figure 2-1. Area of Study and Station Locations with Cruise Track Indicated for MMS Cruise CAMP 2-3, Leg 1, M/V Aloha 19 - 29 October 1987

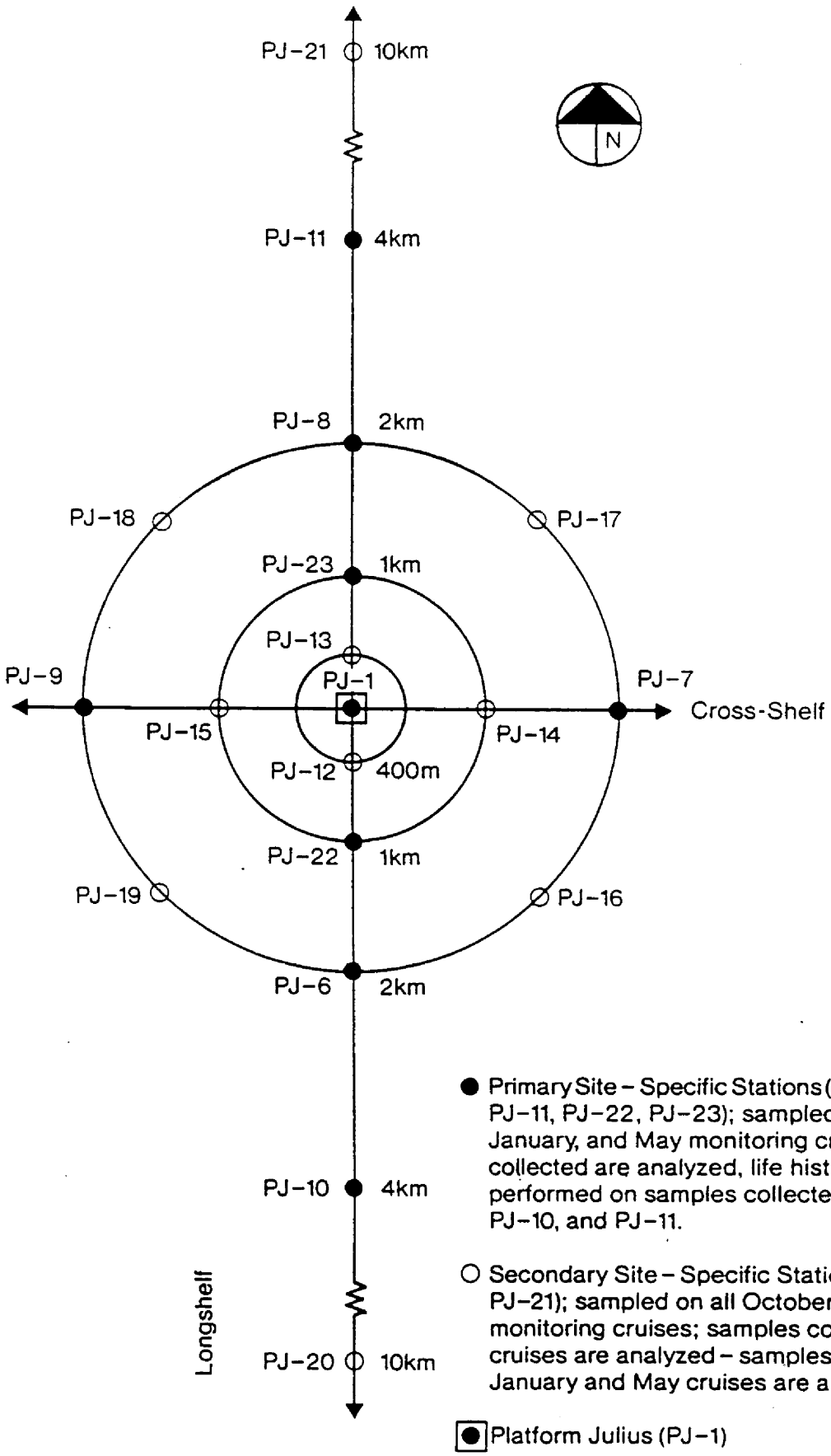



Figure 2-2. Site-Specific Array of Stations Around Platform Julius

TABLE 2-1. SUMMARY OF SAMPLES COLLECTED ON MMS CRUISE CAMP 2-3, LEG 1 (M/V Aloha)

| Sample Type | Number of Stations | Number of Replicates/ Station | Total Number Collected on Cruise | Sample Custody |
|---|---|---|---|---|
| Macrofauna (0-10cm) | 28 | 3 | 84 | Battelle (Ventura) |
| Macrofauna (>10cm) | 10 | 3 | 30 | Battelle (Ventura) |
| Meiofauna | 28 | 3 | 84 | Univ. Texas |
| Core Radiography | 14 | 1(x2)(1) | 14(x2) | Univ. Maine |
| Hydrocarbons (0-2cm): | 28 | 3 | 84 | Battelle (BNW) |
| Hydrocarbons (0-2cm): | 28 | 3 | 84 | Battelle (BNE) |
| Trace Metals (2-10cm): | 4 | 3 | 12 | Battelle (BNW) |
| Hydrocarbons (2-10cm): | 4 | 3 | 12 | Battelle (BNE) |
| Pore-water Chemistry:TM | 4 | 3 | 12 | Battelle (BNW) |
| Pore-water Chemistry:HC | 4 | 3 | 12 | Battelle (BNE) |
| Pb/Th Ratios | 5 | 1 | 5 | Battelle (BNW) |
| Sedimentology | 28 | 3 | 84 | Kinnetics |
| Animal Tissue Chemistry | 3 | 3 | 9 | Battelle (BNE) |
| Hydrography | 9 | 1 | 9 | Kinnetics |

1. One X-ray was taken of each of the two sediment cartridges collected from the 10 x 30-cm subcore.

TABLE 2-2. REGIONAL STATION REFERENCE COORDINATES FOR THE MMS CALIFORNIA OCS PHASE II MONITORING PROGRAM

| Station | Northstar 7000 Latitude Longitude | UTM Coordinates | LORAN Time Delays | Depth (M) |
|---|---|---|---|---|
| R-1 | 35°05.55'N<br>120°49.20'W | N3885790<br>E698776 | 27794.9<br>42044.9 | 91 |
| R-2 | 35°05.13'N<br>120°53.40'W | N3885047<br>E692345 | 27780.8<br>42057.1 | 161 |
| R-3 | 35°04.98'N<br>120°00.84'W | N3884443<br>E680956 | 27756.2<br>42081.0 | 409 |
| R-4 | 34°43.18'N<br>120°47.28'W | N3843676<br>E702399 | 27800.3<br>41921.5 | 92 |
| R-5 | 34°42.85'N<br>120°50.69'W | N3842964<br>E697156 | 27789.8<br>41932.0 | 154 |
| R-6 | 34°41.43'N<br>120°57.78'W | N3840354<br>E686413 | 27768.0<br>41949.8 | 410 |
| R-7 | 34°52.62'N<br>121°10.31'W | N3861248<br>E667092 | 27727.7<br>42047.7 | 565 |
| R-8 | 34°55.24'N<br>120°45.80'W | N3866433<br>E704208 | 27805.6<br>41978.2 | 90 |
| R-9 | 34°53.49'N<br>120°59.03'W | N3863016<br>E684098 | 27763.2<br>42014.9 | 410 |

Revised 11/87

Latitude and Longitude from Northstar 7000 algorithm

TABLE 2-3. PRIMARY SITE-SPECIFIC STATION REFERENCE COORDINATES FOR THE MMS CALIFORNIA OCS PHASE II MONITORING PROGRAM

| Station | Northstar 7000 Latitude Longitude | UTM Coordinates | LORAN Time Delays | Depth (M) |
|---|---|---|---|---|
| PJ-1 | 34°55.65'N<br>120°49.87'W | N3867215<br>E698032 | 27792.5<br>41994.6 | 145 |
| PJ-6 | 34°54.60'N<br>120°49.86'W | N3865215<br>E698076 | 27792.5<br>41989.1 | 148 |
| PJ-7 | 34°55.70'N<br>120°48.57'W | N3867257<br>E700032 | 27796.7<br>41990.3 | 123 |
| PJ-8 | 34°56.76'N<br>120°49.88'W | N3869214<br>E697989 | 27792.5<br>42000.4 | 142 |
| PJ-9 | 34°55.62'N<br>120°51.18'W | N3867171<br>E696033 | 27788.2<br>41999.1 | 169 |
| PJ-10 | 34°53.53'N<br>120°49.85'W | N3863215<br>E698119 | 27792.5<br>41983.6 | 147 |
| PJ-11 | 34°57.82'N<br>120°49.82'W | N3871214<br>E697946 | 27792.6<br>42006.0 | 136 |
| PJ-22 | 34°55.13'N<br>120°49.86'W | N3866217<br>E698034 | 27792.5<br>41991.9 | 143 |
| PJ-23 | 34°56.16'N<br>120°49.86'W | N3868211<br>E698037 | 27792.5<br>41997.3 | 143 |

**Revised 11/87**

**Latitude and Longitude from Northstar 7000 algorithm**

TABLE 2-4. SECONDARY SITE-SPECIFIC STATION REFERENCE COORDINATES FOR THE MMS CALIFORNIA OCS PHASE II MONITORING PROGRAM

| Station | Northstar 7000 Latitude Longitude | UTM Coordinates | LORAN Time Delays | Depth (M) |
|---|---|---|---|---|
| PJ-12 | 34°55.45'N<br>120°49.83'W | N3866815<br>E698041 | 27792.6<br>41993.4 | 145 |
| PJ-13 | 34°55.83'N<br>120°49.89'W | N3867615<br>E698024 | 27792.5<br>41995.6 | 144 |
| PJ-14 | 34°55.69'N<br>120°49.17'W | N3867235<br>E699032 | 27794.8<br>41992.3 | 134 |
| PJ-15 | 34°55.63'N<br>120°50.51'W | N3867192<br>E697033 | 27790.5<br>41996.7 | 155 |
| PJ-16 | 34°54.95'N<br>120°48.94'W | N3865830<br>E699477 | 27795.5<br>41987.7 | 130 |
| PJ-17 | 34°56.43'N<br>120°48.91'W | N3868659<br>E699416 | 27795.6<br>41995.4 | 126 |
| PJ-18 | 34°56.42'N<br>120°50.80'W | N3868597<br>E696589 | 27789.5<br>42001.9 | 158 |
| PJ-19 | 34°54.92'N<br>120°50.76'W | N3865770<br>E696650 | 27789.6<br>41993.8 | 167 |
| PJ-20 | 34°50.39'N<br>120°49.82'W | N3857216<br>E698249 | 27792.5<br>41967.2 | 148 |
| PJ-21 | 35°01.00'N<br>120°51.16'W | N3877228<br>E695936 | 27788.3<br>42027.2 | 143 |

**Revised 11/87**

**Latitude and Longitude from Northstar 7000 algorithm**

Miniranger System on previous cruises. The latitude and longitude coordinates listed in this report are the products of the Northstar 7000 algorithm. The latitudes and longitudes from the Northstar are offset from geodetic coordinates and should not be used for station navigation purposes.

Station depths listed in this report are reference depths, as station depth was not recorded during this cruise.

Time was recorded in Pacific Daylight Time (PDT) until 0200 on 25 October 1987 at which time the clock was changed to 0100 to coincide with Pacific Standard Time (PST). Station reference coordinates are listed in Tables 2-2, 2-3, and 2-4. A summary of sample positions is shown in Appendix A Table 1.

## 2.4 Box Core Sampling

A Hessler-Sandia MK-III box core, vegematically partitioned into 25 individual 0.01-$m^2$ subcores was used to collect sediment (Figure 2-3). Three replicate box cores were collected at each of the nine regional stations (R-1 through R-9) and the 19 site-specific stations (PJ-1 and PJ-6 through PJ-23) for various biological, chemical, and sedimentology parameters. At each of four stations (PJ-1, PJ-8, PJ-10, and PJ-11), three additional box core replicates were collected for the purpose of pore-water chemistry analysis using a quadrilateral 0.25-$m^2$ box.

A total of 96 successful box core samples were collected on Leg 1. Several samples were rejected due to partial sample wash-outs and disturbed sample surface areas. The southern transect of regional stations (R-4, R-5, and R-6) presented the usual sampling difficulties. These stations are notoriously difficult to sample because of the densely packed base sediments and fossilized scallop shells at a level of 13 cm into the sediment. Repeated attempts are generally required at each of these stations before acceptable samples are collected.

The Ocean Instruments DEEP-EYE Camera System was to be mounted on the box core for the purpose of acquiring epifauna photographs. Subsequent to the May monitoring cruise, a pressure sensitive switch was added to the camera housing in order to prevent the camera from taking photographs near the water surface during deployments, recoveries, and rough seas. Due to the result of an engineering oversight, the modified camera housing was unable to fit on the camera mounting platform of the box core. Modifying the camera mounting platform while at sea would have consumed valuable sampling time and the decision was made to forego the collection epifauna photographs for the Soft-Bottom Cruise. The camera mounting platform will be modified prior to the January 1988 Soft-Bottom Cruise.

Prior to this cruise the coring winch aboard the M/V Aloha was equipped with torque-balanced wire. This wire was obtained at no cost to the project as a result of a cooperative arrangement between USGS and SCRIPPS. The installation of this wire has greatly improved box-coring activities by eliminating excessive damage to the box core pennant cables.

Please note that only box core samples collected at all regional stations and three primary site-specific stations (PJ-1, PJ-10, and PJ-11) are to be analyzed. All other samples are to be archived until further notice.

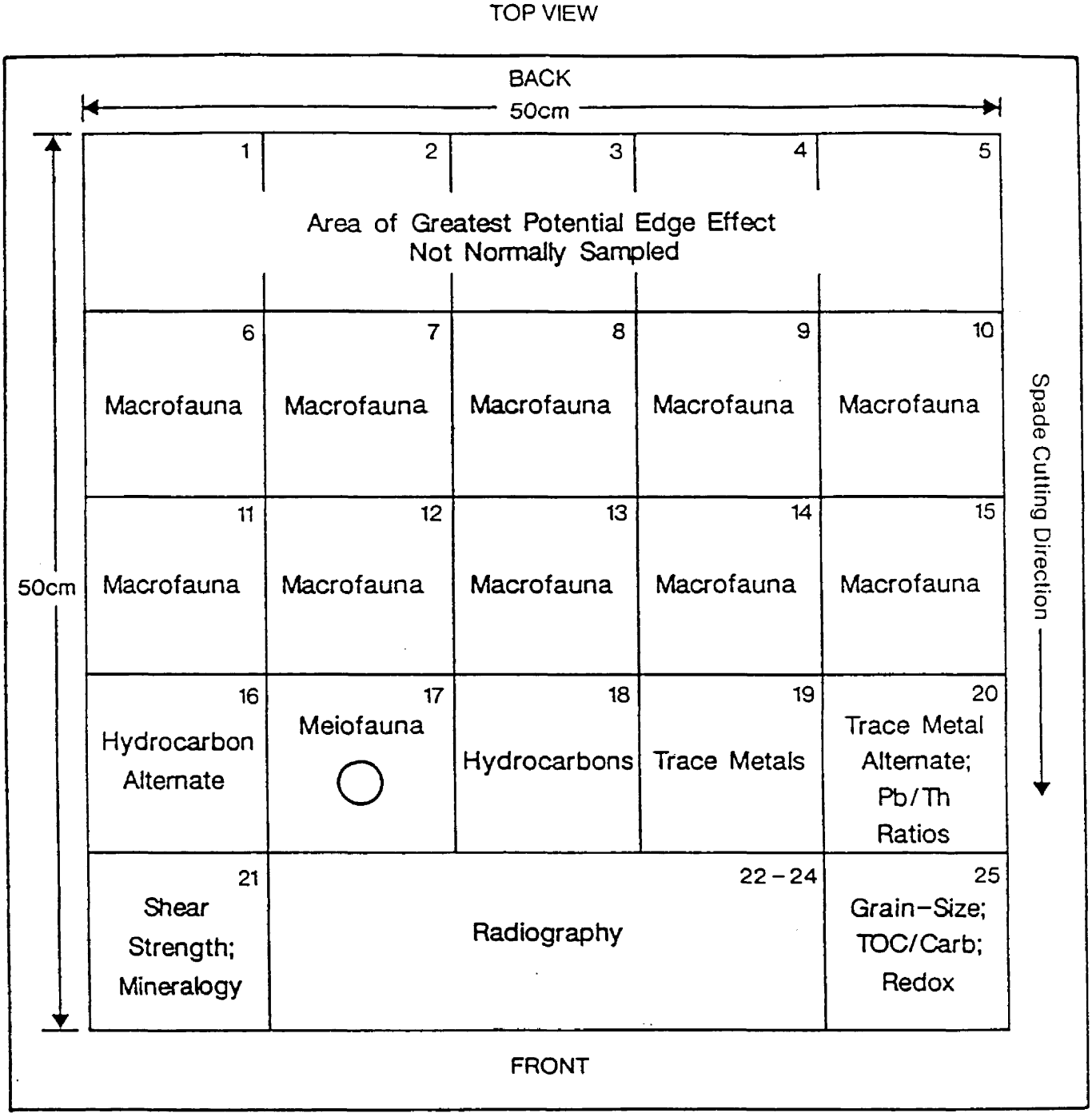



Figure 2-3. "Vegematic" Partitioning of the 0.25-$M^2$ Box Core. Cores Designated for Macrofauna, Meiofauna, Chemistry, Radiography, and Various Sedimentology Parameters are Indicated.

## 2.5 Biology

From each of three replicate box cores at each of the nine regional stations (R-1 through R-9) and the 19 site-specific stations (PJ-1 and PJ-6 through PJ-23), ten subcores (Subcore Numbers 6-15) were collected for benthic macroinfauna, and one subcore (Subcore Number 17) was used to take a single 2-cm diameter sample for meiofauna.

Macrofaunal samples were processed on board ship in the following manner. The subcores were removed individually from the box and the upper 10 cm of sediment were extruded, cut, and placed in an elutriating bucket. The remaining portion of the subcore (>10 cm) also was extruded and placed in an elutriating bucket. Three to four subcores were extruded and placed in one elutriating bucket. The 0 to 10-cm fraction was processed with filtered seawater through a 0.3-mm sieve, and the >10-cm fraction was processed through a 1.0-mm mesh sieve. The residue from both fractions was rinsed into separate 16-oz glass jars and preserved with approximately 10-percent buffered formalin. The >10-cm fraction was collected at all regional stations and at PJ-1.

Meiofauna samples were extruded from the core tubes to a 10-cm fraction at 2-cm intervals and relaxed for 5 minutes in MgCl, followed by preservation in 5-percent formalin and storage in 60-ml plastic tubes.

## 2.6 Chemistry

From each of three replicate box cores at each of the 28 stations (regionals and site-specifics) a 0 to 2-cm Trace Metal (TM) chemistry sample was collected from a Teflon-coated subcore (Subcore No. 19) and a 0 to 2-cm Hydrocarbon Chemistry (HC) sample was collected from a solvent-rinsed subcore (Subcore No. 18). Sediment Trace Metal and Hydrocarbon samples were frozen following collection.

At four site-specific stations (PJ-1, PJ-8, PJ-10, and PJ-11), the upper 10 cm of Subcores No. 19 and No. 18 were collected for TM and HC, respectively. These cores were sectioned into 0 to 2-cm and 2 to 10-cm fractions. The lower sediment core sections were collected for the determination of the vertical extent of TM and HC penetration. At four site-specific stations, the same stations designated for 0 to 10-cm sediment chemistry cores (i.e., PJ-1, PJ-8, PJ-10, and PJ-11), three additional box-core replicates were collected for pore-water chemistry analysis using a quadrilateral 0.25-$m^2$ box. The entire 0 to 2-cm surface area was collected from these box cores and processed, preserved, and stored for subsequent laboratory analysis. The collection of pore-water samples at PJ-10 was difficult due to the washing-out of compact sediments from the quadrilateral box. Repeated collection attempts provided marginal to acceptable pore-water samples at PJ-10. The actual yield of pore water from the on-board processing of the PJ-10 samples was low in comparison to the pore-water samples collected at PJ-1, PJ-8, and PJ-11. These results are consistent with the pore-water sampling on the three previous soft-bottom cruises. Improvements to the pore-water squeezers and methods significantly facilitated the on-board processing and increased the quantity of yield.

At one regional stations (R-9) and four site-specific stations (PJ-1, PJ-8, PJ-10, and PJ-11), one subcore (Subcore No. 20) was taken from one of the replicate box cores for the analysis of Lead and Thorium isotope ratios. The Pb/Th ratio

sample was collected by inserting an acid-washed CAB core liner into the subcore and capping both ends. The samples were frozen subsequently and archived.

A string of three baited animal traps was deployed at each of three selected stations (R-2, PJ-1, and PJ-11) for the collection of animal tissue samples for hydrocarbon and trace metal body-burden analyses. The traps were deployed for approximately 48 hours and the collected animals were frozen. A summary of the catches is in Appendix A Table 2 and in the chemistry tissue logs.

Several quality assurance samples and blanks were collected for chemistry analyses. These samples, which will be analyzed to detect any background contamination, are as follows:

1. Ship's hydraulic fluid samples for hydrocarbons
2. Air exposure samples for hydrocarbons
3. Milli-Q water filtered through the pore-water apparatus for trace metals and hydrocarbons
4. One Sequim Bay sea-water sample filtered through the pore-water apparatus for trace metals and hydrocarbons.

## 2.7 Sedimentology

Samples were collected from each of the three replicate box cores at each of the 28 stations in the Platform Julius study area (9 regional and 19 site-specific stations) for the determination of sediment properties. Measurements and samples for TOC, carbonate, grain size, and REDOX were taken from Subcore No. 25. At all stations, sediment shear-strength measurements and mineralogy samples were taken from Subcore No. 21. Only mineralogy samples collected at 10 stations (R-1 through R-7; and PJ-1, PJ-10, and PJ-11), will be analyzed. All other mineralogy samples are to be archived. All sedimentology samples were collected with the exception of a single mineralogy sample at Station R-9 replicate three, resulting from an oversight.

## 2.8 Core Radiography

At 14 stations (R-1 through R-9 and PJ-1, PJ-10, PJ-11, PJ-22, and PJ-23), a specially designed 10 x 30-cm subcore (in place of Subcores No. 22, 23, and 24) was removed from one of the boxcore replicates for x-ray analysis (for evidence of bioturbation). Two plastic cartiridges were inserted into the subcore and surrounding mud was washed away. Immediately following collection, sediment cartridges were x-rayed in the ship's laboratory and the photos were developed in the darkroom. The sediment cartridges were examined for sediment appearance and contents.

## 2.9 Hydrography

A single Niskin bottle equipped with two deep-sea reversing thermometers (DSRT) was deployed at each of the nine regional stations (R-1 through R-9), to collect samples for the determination of near-bottom dissolved oxygen, salinity, and temperature. Dissolved oxygen was measured in triplicate on board using the Winkler titrimetric method. Salinity samples were measured using a Hanna H-18333 conductivity probe. Temperature was recorded from the reversing thermometers.

## 2.10 Cruise Participants

Participants on Cruise CAMP 2-3, Leg 1 and their affiliations were:

Battelle

James Campbell, Chief Scientist
Janet Kennedy, Second Scientist
Steven Mellenthien
Heidi De Bra
Christie Dolstra

Kinnetic Laboratories, Inc.

Gary Gillingham
Elliott Gilder
Sherry Hamer
Roanne Hudnall
Ken Kronschnabl

University of Maine

Linda McCann

University of Texas

John Kern

## 2.11 Acknowledgements

The Chief Scientist and Second Scientist wish to thank the scientific personnel for their untiring dedication and hard work which resulted in another extremely successful cruise. Many thanks to the crew of the Aloha for their ship handling expertise and deck support. It was a blast.

# 3.0 SEDIMENT-TRANSPORT INSTRUMENT-RETRIEVAL CRUISE - LEG 2 REPORT

# 3.0 SEDIMENT-TRANSPORT INSTRUMENT-RETRIEVAL CRUISE - LEG 2 REPORT
31 October -3 November 1987

## 3.1 Objective

The objective of this short cruise was to attempt to locate and recover a current-meter mooring deployed at 34°53.7'N, 120°59.5'W (Station C, Figure 3-1) in about 400 m of water off Point Sal. The mooring, containing three EG&G vector-averaging current meters, was deployed as part of the California Monitoring Program (CAMP) in May 1987 and was to be recovered in July 1987. No attempt could be made to recover or interrogate the mooring on the July cruise because of heavy weather and ship equipment failures. Recovery was re-scheduled for September. On this cruise, the mooring did not respond to any acoustic commands; it was assumed either that the release had failed or that the mooring was dragged away by fishing activity. Because of the equipment and importance of the data, an additional acoustic search using the release gear, a side-scan sonar search with an EG&G 50 Khz system, and a search utilizing a remotely operated vehicle (ROV) were planned to attempt to locate the lost mooring.

## 3.2 Scientific Personnel

Brad Butman, USGS, Chief Scientist
Bill Strahle, USGS, Electrical Engineer
Mike Boyle, USGS, Side-Scan Technician
Dane Hardin, Kinnetic Laboratories, Inc.
Mark Mertz, Kinnetic Laboratories, Inc.
Bob Dellaert, Land and Sea Surveys, Inc.
James Cooley, Land and Sea Surveys, Inc.

## 3.3 Activities

| | | |
|---|---|---|
| 10/31/87 | 0800-2300 | Mobilized M/V Aloha |
| 11/11/01 | 0001 | Departed Ventura. Steamed toward mooring location. Extremely slow progress due to head winds and sea. |
| | 1600 | Attempted to interrogate release. |
| | 1800 | Attempted to interrogate release. |
| | 1940 | Arrived mooring location. Too rough for ROV. |
| | 2100 | Began side-scan search. |
| | 2255 | Terminated side-scan search - seas too rough for Aloha to maintain steerage. Headed for Port San Luis. |
| 11/02/87 | 0400 | Arrived Port San Luis. |
| | 0850 | Departed Port San Luis. |
| | 1150 | Arrived Station C. Still too rough for ROV. |
| | 1214 | Started side-scan search. Lines NW-SE. |
| | 2400 | Terminated side-scan search. |
| 11/03/87 | 0100 | Dove ROV on mooring location. |
| | 0245 | Terminated ROV search. |
| | 0530 | Arrived Port San Luis and offloaded. |

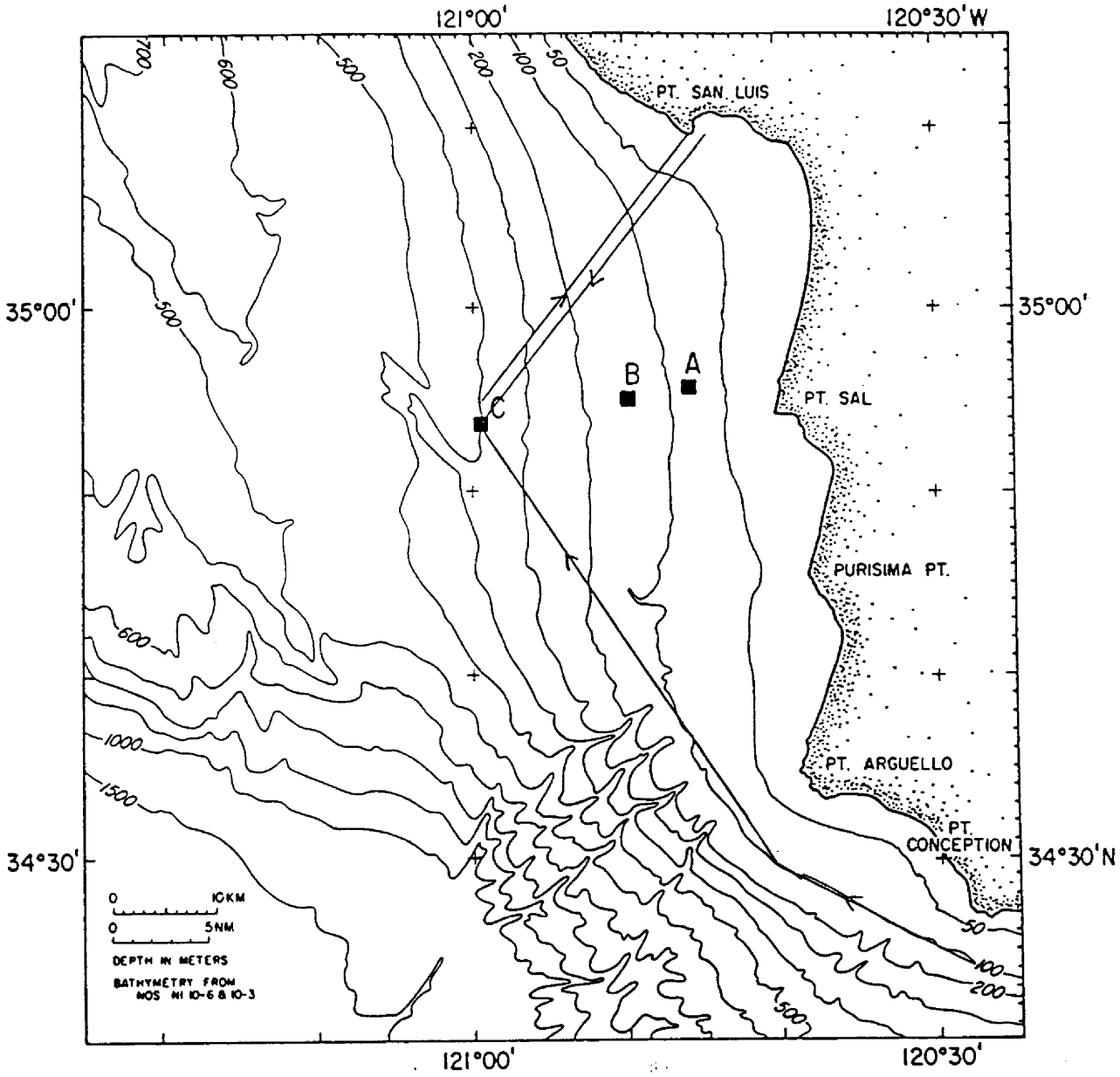



Figure 3-1. Area of Study with Cruise Track Indicated for MMS Cruise CAMP 2-3, Leg 2, M/V Aloha 31 October - 3 November 1987. Detailed Side-Scan Sonar Survey Track Not Shown.

## 3.4 Summary

The mooring was not located using any of the search techniques. The acoustic search for the release was conducted over an area approximately 5 nautical miles north, south, east, and west of the site where the mooring was originally deployed (including sites surveyed on the September Aloha cruise). The side-scan search was conducted along lines about 4 miles long (2 miles either side of the mooring site) running approximately NW-SE and spaced 100 m apart. The length of the lines was dictated by the distance necessary for the side-scan fish to straighten out following turns. It was originally planned to run the lines along-isobath (north-south) to provide maximum coverage in the preferred direction for dragging, but the weather and swell required the lines to be run NW-SE in order to maintain maneuverability. The side-scan was set on a 100 m range so the line coverage overlapped about 50 percent. In the time allotted for this search, seven side-scan lines were run (three to each side of the mooring site and one through it). Coverage extended about 560 m in the along-isobath and cross-isobath direction in the immediate vicinity of the mooring. All navigation during the side-scan survey was conducted using the Land and Sea system; the ship position on the desired track was excellent throughout the survey. No obvious side-scan target was located. However, extensive trawl marks were observed throughout the region, especially at the depth range of the mooring. Most trawl marks were along-isobath, but many also were oblique to the isobaths; if moved by trawlers, the mooring could be in any direction from the original site.

At the very end of the cruise, the seas had calmed sufficiently to enable a brief search with the ROV. A sonar search (100 m radius) at about 375 m depth (the depth of the near-bottom mooring flotation) at the mooring site and 100 m to the north of the mooring site indicated no target. No more time was available for further search or for investigation of the seafloor (however, as noted in the next section, additional ROV searches were performed on the subsequent leg).

Based on this search, it is concluded that the mooring is lost, and that the most probable cause of loss is an accidental encounter with fishing activity. Additional searches could be conducted, but since the mooring was not located near the mooring site, the chances of locating it elsewhere are minimal and not economical.

## 3.5 Navigation

The firm of Land and Sea Surveys, Inc., provided navigational services for this leg. A detailed description of the navigation equipment and services is provided in the next section.

# 4.0 PHYSICAL OCEANOGRAPHY/HARD-BOTTOM SURVEY - LEG 3 REPORT

# 4.0 PHYSICAL OCEANOGRAPHY/HARD-BOTTOM SURVEY - LEG 3 REPORT
31 October - 12 November 1987

## 4.1 Objectives

1. To collect 80 replicate random 70-mm photoquadrats from each high-relief location (three) and each low-relief location (eight) at the Hidalgo site (Figure 4-1).

2. To collect three replicate grab samples for Trace Metals, Hydrocarbons and Sedimentology parameters from nine Hidalgo locations.

3. To collect animal samples for tissue analyses from three Hidalgo locations.

4. To retrieve, service, and redeploy current meters at the Hidalgo and Julius sites.

5. To obtain water quality profiles and hydrographic casts from two locations at the Hidalgo and Julius sites.

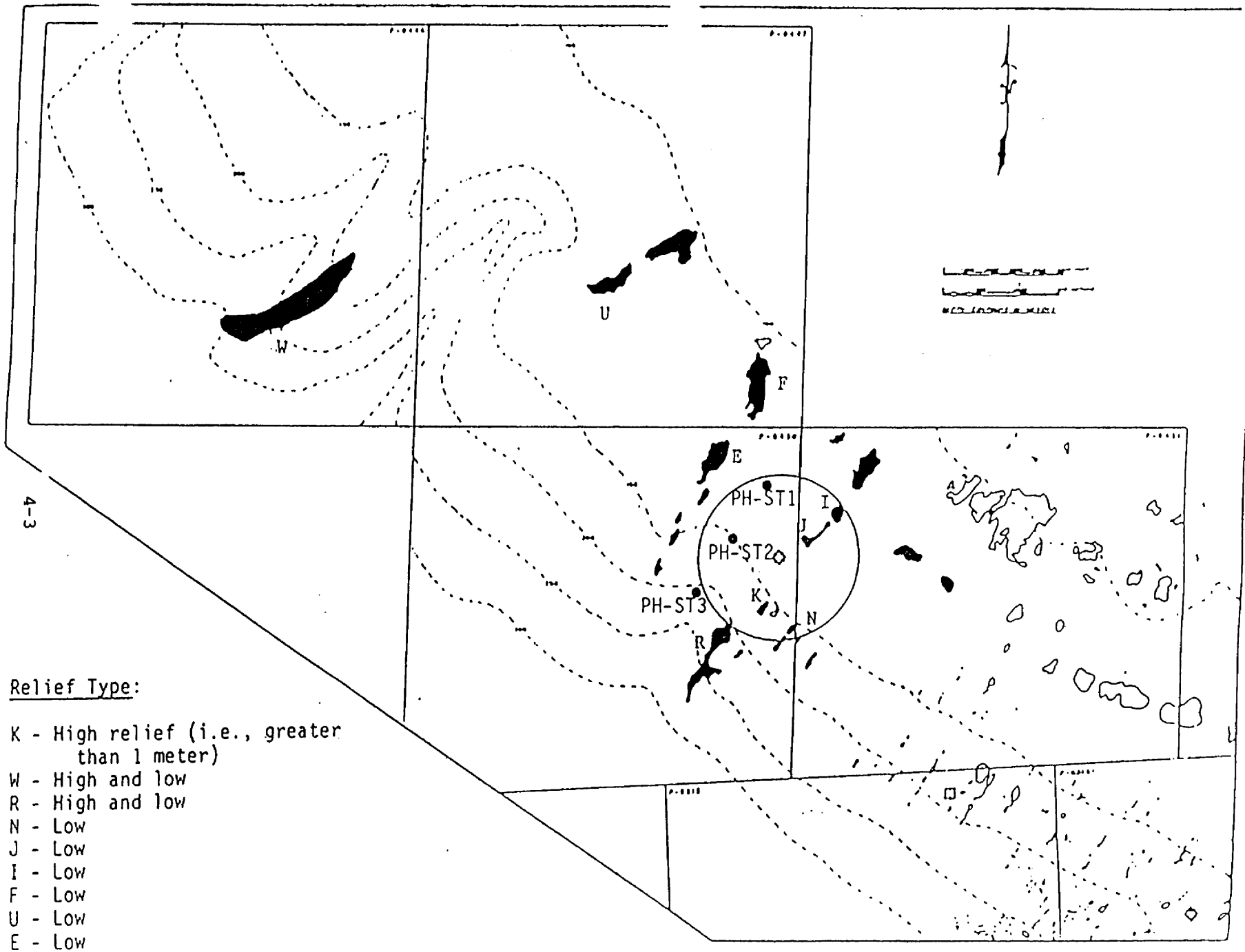
## 4.2 Scientific Personnel

| Name | Affiliation | Responsibility | Dates |
|---|---|---|---|
| D. Beard | KLI | Physical Oceanography | 11/07-11/09 |
| J. Cooley | Land & Sea | Navigation | 10/31-11/12 |
| R. Dellaert | Land & Sea | Navigation | 10/31-11/12 |
| D. Hardin | KLI | Chief Scientist | 10/31-11/12 |
| J. Kennedy | Battelle | Sediment/Tissue Chemistry | 11/03-11/07 |
| S. Kinney | KLI | Field Support | 11/07-11/12 |
| M. Mertz | KLI | Physical Oceanography | 10/31-11/03<br>11/07-11/12 |
| D. Panzer | MMS | Observer | 11/03-11/07 |
| T. Parr | KLI | Video and Photo Sampling | 11/03-11/07 |
| J. Shrake | KLI | Video and Photo Sampling | 11/03-11/07 |
| P. Wilde | KLI | Physical Oceanography | 11/07-11/12 |

## 4.3 Activities

| | | |
|---|---|---|
| 10/31/87 | 1500-2300 | Mobilized M/V Aloha. |
| 11/01/87 | 0001 | Departed Ventura Harbor. |
| 11/01-11/3/87 | | Searched for USGS equipment. |
| 11/03/87 | 0830 | Departed Port San Luis. |
| | 1550 | Photos taken at PH-U. |
| | 1930 | Photos taken at PH-F. |
| 11/04/87 | 0020 | Photos taken at PH-E. |
| | 0230 | Photos taken at PH-I. |
| | 1100 | Deployed animal traps at PHA-1, PHA-2, and PHA-3. |
| | 1245 | Photos taken at PH-J. |
| | 1650 | Low-relief photos taken at PH-R. |
| | 1730 | Animal traps at PHA-1 moved to 500 m from Hidalgo after concern expressed by platform personnel. |
| | 2245 | High-relief photos taken at PH-R. |

| | | |
|---|---|---|
| 11/05/87 | 0120 | Photos taken at PH-N. |
| | 0335 | Photos taken at PH-K. |
| | 1020 | High-relief photos taken at PH-W. |
| | 1320 | Low-relief photos taken at PH-W. |
| | 1915 | Sediment grabs taken at PH-W. |
| | 2045 | Sediment grabs taken at PH-U. |
| | 2145 | Sediment grabs taken at PH-F. |
| | 2300 | Sediment grabs taken at PH-E. |
| 11/06/87 | 1030 | Sediment grabs taken at PH-I. |
| | 1145 | Sediment grabs taken at PH-J. |
| | 1345 | Sediment grabs taken at PH-R. |
| | 1500 | Sediment grabs taken at PH-N. |
| | 1715 | Animal traps recovered from PHA-1, PHA-2, and PHA-3. |
| | 1800 | Sediment grabs taken at PH-K. |
| | 1815 | Departed for USGS site at R-9. |
| | 2100-2400 | Conducted ROV searches with Mesotech, departed for Port San Luis. |
| 11/07/87 | 0730 | Departed for PJ-13A. |
| | 1400 | Current meters and telemetry system on board. |
| | 1600 | Hydorgraphic cast made at PJ-11. |
| | 1630 | Water quality profile taken at PJ-11. |
| | 1715 | Hydrographic cast made at PJ-13. |
| | 1730 | Water quality profile taken at PJ-13. |
| | 2015 | Hydrographic cast made at Hydro 2 (4 km from Hidalgo). |
| | 2030 | Water quality profile taken at Hydro 2. |
| | 2100 | Hydrographic cast made at Hydro 1 (0.7 km from Hidalgo). |
| | 2115 | Water quality profile taken at Hydro 1. |
| 11/08/87 | 0800 | Current meters and telemetry system from Hidalgo on board. |
| | 1100 | Arrived Port San Luis. |
| 11/08-11/10/87 | | Cleaned and serviced current meter moorings. |
| 11/10/87 | 1630 | Current meters and telemetry system redeployed at Hidalgo. |
| | 1830 | Arrived in Port San Luis. |
| | 2330 | Current meters and telemetry system ready for deployment at Hidalgo. |
| 11/11/87 | 0330 | Departed for Hidalgo site. |
| | 1030 | Current meters and telemetry system deployed at Hidalgo. |
| | 1420 | Confirmed telemetry system operation and departed for Ventura Harbor. |
| | 2145 | Arrived Ventura Harbor. |
| 11/12/87 | 0800-1100 | Demobilized M/V Aloha. |




Relief Type:

K - High relief (i.e., greater than 1 meter)
W - High and low
R - High and low
N - Low
J - Low
I - Low
F - Low
U - Low
E - Low

Figure 4-1. Hard-Bottom Features for Site-Specific Monitoring Near Platform Hidalgo

## 4.4 Results

Photoquadrats (Objective 1)

All the photoquadrats were obtained. Although the operation proceeded very smoothly, some minor delays were experienced due to misfires of the strobe. The misfires were caused by insufficient charge on the batteries, and will be alleviated in the future by developing a better memory on the nicad batteries before using them.

Grab Samples (Objective 2)

The collection of the sediment samples also went very smoothly. In the calm conditions we experienced, the modified Van Veen grab collected the best, least disturbed sample when all the weights were removed and the plywood baffles were attached to prevent over-penetration. A summary of sample positions is shown in Appendix B Table 1.

Animal Traps (Objective 3)

Animals were collected from all three stations. Crabs of the genus Cancer, seastars (Pycnopodia helianthoides), and Pleurobranchaea predominated. PHA-1 was moved to 500 m away from Platform Hidalgo to avoid interference between the surface buoy and normal traffic around the platform (Appendix B Table 2).

Physical Oceanography (Objective 4)

The current meters and telemetry systems were successfully recovered. The mooring at PJ-13A was recovered by snagging the groundline with a grappling hook when the release failed to respond. The release line was out of the canister and tangled, suggesting that the secondary anchor had been hit by some object. The release was lost, apparently when the tangled release line was caught in the ship's screws.

Two current meters failed to store data. The bottom meter at Hidalgo had stored unintelligible information. This meter had not transmitted to the telemetry system since 4 September 1987. The middle meter at PJ-13A had a bad alkaline battery in the memory circuit, but had uninterrupted transmission to the telemetry system. In both of these cases, the telemetry system assured the return of data (6-hour averages) even though the meters themselves were not storing data internally.

When the moorings were serviced, two modifications were made that may alleviate the problems we recently experienced:

1. The programming of the data logger was corrected to prevent premature battery drain. It was found that during periods when the data logger was quiet, it was drawing 6 milliamps instead of the intended 1 milliamp. This high current drain required a 1-day cruise on 6 October 1987 with the R/V Spirit to replace batteries in the telemetry buoys.

2. Temperature and humidity sensors were installed in each telemetry buoy so that data from them are transmitted with the other data. Several days after the 6 October visit to replace batteries, the mooring at PJ-13A stopped

transmitting. Another 1-day cruise with the R/V Spirit on 22 October 1987 determined that the mooring was intact, but the telemetry buoy had leaked. The temperature and humidity data will enable us to be aware of leaks and repair them without interruption of data transmission.

Deployment of the moorings after servicing went smoothly. The middle and bottom meters at PJ-13A, however, stopped functioning when the mooring was deployed. The bottom meter came on line again within a few hours, but the middle meter has not transmitted data to the telemetry system. It may, however, be recording data internally.

Water Quality Profiles (Objective 5)

All water quality profiles and hydrographic casts were obtained at the two Hidalgo and Julius locations.

## 4.5 Navigation

The firm of Land and Sea Surveys, Inc., provided navigational services for Legs 2 and 3. Station locations established on Cruises CAMP 1-1 and CAMP 1-2 were revisited using the Motorola Miniranger system. The Miniranger system was interfaced to a 9826 Hewlett Packard computer, which was linked to three color monitors (navigation lab, bridge, and ROV shack) to display the ship's position graphically. A Thinkjet printer and a 7475A Hewlett Packard plotter provided hard copy printouts of Universal Transverse Mercator (UTM) coordinates and station plots. Land and Sea also provided the Ferranti O.R.E. Trackpoint system enabling the subsurface monitoring of I.U.C.'s Recon IV Remotely Operated Vehicle (ROV) during the hard-bottom surveys. Land and Sea's Mesotech Sonar enabled directional monitoring of the sea floor relief within a 100-meter radius. Reference coordinates of hard-bottom photosurvey sites and grab stations are listed in Tables 4-1 and 4-2.

TABLE 4-1. REFERENCE COORDINATES OF HIGH AND LOW RELIEF HARD-BOTTOM PHOTOSURVEY SITES FOR THE MMS CALIFORNIA OCS PHASE II MONITORING PROGRAM

| Station | Latitude Longitude | UTM Coordinates | Depth (M) | Relief Type |
|---|---|---|---|---|
| PH-E | 34°30.26'N 120°42.76'W | N3820250 E710000 | 119 | Low |
| PH-F | 34°30.81'N 120°42.36'W | N3821285 E710580 | 105 | Low |
| PH-I | 34°29'96'N 120°41.68'W | N3819735 E711665 | 107 | Low |
| PH-J | 34°29.82'N 120°41.82'W | N3819480 E711450 | 117 | Low |
| PH-K | 34°29.37'N 120°42.26'W | N3818635 E710795 | 160 | High |
| PH-N | 34°29.21'N 120°42.05'W | N3818345 E711125 | 166 | Low |
| PH-R | 34°29.11'N 120°42.67'W | N3818140 E710180 | 213 | High/Low |
| PH-U | 34°31.48'N 120°43.51'W | N3822480 E708800 | 113 | Low |
| PH-W | 34°31.52'N 120°45.86'W | N3822480 E705200 | 195 | High/Low |

High relief is greater than one (1) meter.

TABLE 4-2. HARD-BOTTOM GRAB STATION REFERENCE COORDINATES FOR THE MMS CALIFORNIA OCS PHASE II MONITORING PROGRAM

| Station | Latitude Longitude | UTM Coordinates | Depth (M) |
|---|---|---|---|
| PH-E | 34°30.19'N<br>120°42.68'W | N3820125<br>E710125 | 119 |
| PH-F | 34°30.79'N<br>120°42.52'W | N3821250<br>E710350 | 105 |
| PH-I | 34°29.98'N<br>120°41.70'W | N3819770<br>E711629 | 107 |
| PH-J | 34°29.83'N<br>120°41.86'W | N3819500<br>E711400 | 117 |
| PH-K | 34°29.41'N<br>120°42.29'W | N3818700<br>E710750 | 160 |
| PH-N | 34°29.24'N<br>120°42.10'W | N3818400<br>E711050 | 166 |
| PH-R | 34°29.17'N<br>120°42.46'W | N3818250<br>E710500 | 213 |
| PH-U | 34°31.41'N<br>120°43.47'W | N3822370<br>E708870 | 113 |
| PH-W | 34°31.58'N<br>120°45.68'W | N3822591<br>E705464 | 195 |

Revised 11/87

# APPENDIX A

TABLE 1. SUMMARY OF SAMPLE POSITIONS ON CRUISE CAMP 2-3, LEG 1 (R/V Aloha)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| R-1 | Reference Coordinates | | 35°05.55'N<br>120°49.20'W | 27794.9<br>42044.9 | 91 | |
| R-1 | 21 Oct 87<br>2340 | Box Core 1 | 35°05.54'N<br>120°49.20'W | 27794.9<br>42044.8 | 91 | Good sample. Penetration to 15 cm. High sand content in samples. |
| R-1 | 22 Oct 87<br>0117 | Box Core 2 | 35°05.55'N<br>120°49.20'W | 27794.9<br>42044.9 | 91 | First attempt no trip. Penetration to 15 cm. Meiofauna cores shallow. |
| R-1 | 22 Oct 87<br>0309 | Box Core 3 | 35°05.53'N<br>120°49.26'W | 27794.9<br>42044.9 | 91 | Excellent surfaces. Shallow penetration. |
| R-1 | 22 Oct 87<br>0154 | Hydrocast | 35°05.53'N<br>120°49.22'W | 27794.9<br>42044.9 | 91 | |
| R-2 | Reference Coordinates | | 35°05.13'N<br>120°53.40'W | 27780.8<br>42057.1 | 161 | |
| R-2 | 21 Oct 87<br>1548 | Box Core 1 | 35°05.13'N<br>120°53.40'W | 27780.8<br>42057.0 | 161 | First attempt discarded due to poor position. Hydraulic leak on winch, deck scrubbed. |
| R-2 | 21 Oct 87<br>1825 | Box Core 2 | 35°05.16'N<br>120°53.42'W | 27780.8<br>42057.2 | 161 | Good sample; much biota in samples. |
| R-2 | 21 Oct 87<br>2021 | Box Core 3 | 35°05.13'N<br>120°53.40'W | 27780.8<br>42056.9 | 161 | Good sample; 25 cm penetration. |
| R-2 | 21 Oct 87<br>1703 | Hydrocast | 35°05.14'N<br>120°53.45'W | 27780.7<br>42057.2 | 161 | |

TABLE 1. SUMMARY OF SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 1 (M/V Aloha) (Continued)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| R-3 | Reference Coordinates | | 35°04.98'N<br>121°00.84'W | 27756.2<br>42081.0 | 409 | |
| R-3 | 21 Oct 87<br>0542 | Box Core 1 | 35°04.97'N<br>121°00.84'W | 27756.1<br>42080.9 | 409 | Extremely soft sediment. Corer piston pins secured to corer. |
| R-3 | 21 Oct 87<br>0853 | Box Core 2 | 35°04.99'N<br>121°00.84'W | 27756.2<br>42081.0 | 409 | Stopped winch during recovery to disperse oil sheen off stern. |
| R-3 | 21 Oct 87<br>1259 | Box Core 3 | 35°04.98'N<br>121°00.81'W | 27756.3<br>42080.9 | 409 | Three previous attempts no trips. Winch leaking hydraulic fluid. |
| R-3 | 21 Oct 87<br>0502 | Hydrocast | 35°04.99'N<br>121°00.83'W | 27756.2<br>42081.0 | 409 | |
| R-4 | Reference Coordinates | | 34°43.18'N<br>120°47.28'W | 27800.3<br>41921.5 | 92 | |
| R-4 | 28 Oct 87<br>0354 | Box Core 1 | 34°43.15'N<br>120°47.28'W | 27800.3<br>41921.4 | 92 | Penetration to 20 cm. Wood debris in samples, much detritus. |
| R-4 | 28 Oct 87<br>0524 | Box Core 2 | 34°43.11'N<br>120°47.30'W | 27800.3<br>41921.3 | 92 | Much detritus. |
| R-4 | 28 Oct 87<br>0804 | Box Core 3 | 34°43.14'N<br>120°47.32'W | 27800.2<br>41921.5 | 92 | Good sample. Last core of cruise. |
| R-4 | 28 Oct 87<br>0715 | Hydrocast | 34°43.14'N<br>120°47.30'W | 27800.3<br>41921.5 | 92 | |

TABLE 1. SUMMARY OF SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 1 (M/V Aloha) (Continued)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| R-5 | Reference Coordinates | | 34°42.85'N<br>120°50.69'W | 27789.8<br>41932.0 | 154 | |
| R-5 | 27 Oct 87<br>2011 | Box Core 1 | 34°42.84'N<br>120°50.67'W | 27789.8<br>41931.9 | 154 | First attempt unacceptable due to shallow penetration. Fossilized scallop shells present, alternate cores used. |
| R-5 | 28 Oct 87<br>0034 | Box Core 2 | 34°42.84'N<br>120°50.66'W | 27789.9<br>41931.9 | 154 | Two previous attempts unacceptable due to shallow penetration. |
| R-5 | 28 Oct 87<br>0230 | Box Core 3 | 34°42.81'N<br>120°50.69'W | 27789.7<br>41931.7 | 154 | Back row of macrofauna subcores washed-out; alternate cores used. |
| R-5 | 27 Oct 87<br>2153 | Hydrocast | 34°42.85'N<br>120°50.68'W | 27789.8<br>41931.9 | 154 | |
| R-6 | Reference Coordinates | | 34°41.43'N<br>120°57.78'W | 27768.0<br>41949.8 | 410 | |
| R-6 | 27 Oct 87<br>1114 | Box Core 1 | 34°41.43'N<br>120°57.76'W | 27768.1<br>41949.7 | 410 | Three previous attempts washouts. Sample dense with scavenging amphipods and gastropods, also decaying material and red urchin. |
| R-6 | 27 Oct 87<br>1443 | Box Core 2 | 34°41.40'N<br>120°57.79'W | 27768.0<br>41949.7 | 410 | Trawl wire fouled on first attempt. Loosely packed sediment, some alternates used. |
| R-6 | 27 Oct 87<br>1738 | Box Core 3 | 34°41.43'N<br>120°57.78'W | 27768.0<br>41949.7 | 410 | Two previous attempts: pre-trip, no-trip. Penetration to 14 cm. Compact lower layers. |
| R-6 | 27 Oct 87<br>1634 | Hydrocast | 34°41.40'N<br>120°57.77'W | 27768.0<br>41949.6 | 410 | |

TABLE 1. SUMMARY OF SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 1 (M/V Aloha (Continued)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| R-7 | Reference Coordinates | | 34°52.62'N<br>121°10.31'W | 27727.7<br>42047.7 | 565 | |
| R-7 | 20 Oct 87<br>1507 | Box Core 1 | 34°52.63'N<br>121°10.30'W | 27727.4<br>42047.7 | 565 | Very soft green mud. Corer piston pins secured. Undisturbed surface. |
| R-7 | 20 Oct 87<br>1741 | Box Core 2 | 34°52.62'N<br>121°10.31'W | 27727.7<br>42047.7 | 565 | Penetration to 25 cm. Undisturbed surfaces. |
| R-7 | 20 Oct 87<br>2348 | Box Core 3 | 34°52.61'N<br>121°10.31'W | 27727.7<br>42047.7 | 565 | First attempt, winch wire dangerously fouled on drum. Penetration to 20 cm. |
| R-7 | 21 Oct 87<br>0233 | Hydrocast | 34°52.61'N<br>121°10.31'W | 27727.7<br>42047.6 | 565 | |
| R-8 | Reference Coordinates | | 34°55.24'N<br>120°45.80'W | 27805.6<br>41978.2 | 90 | |
| R-8 | 22 Oct 87<br>1644 | Box Core 1 | 34°55.23'N<br>120°45.81'W | 27805.6<br>41978.2 | 90 | Acceptable sample. Penetration to 15 cm. Undisturbed surfaces. |
| R-8 | 22 Oct 87<br>1826 | Box Core 2 | 34°55.24'N<br>120°45.80'W | 27805.6<br>41978.2 | 90 | Acceptable sample, some alternate cores used. Loosely packed sediment. |
| R-8 | 22 Oct 87<br>2036 | Box Core 3 | 34°55.24'N<br>120°45.84'W | 27805.4<br>41978.3 | 90 | X-ray subcore used as alternate macrofauna. High sand content, compact lower layers. |
| R-8 | 22 Oct 87<br>1634 | Hydrocast | 34°55.26'N<br>120°45.80'W | 27805.6<br>41978.3 | 90 | Steering down for 30 minutes. Good sample. |

TABLE 1. SUMMARY OF SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 1 (M/V Aloha) (Continued)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| R-9 | Reference Coordinates | | 34°53.49'N<br>120°59.03'W | 27763.2<br>42014.9 | 410 | |
| R-9 | 22 Oct 87<br>0531 | Box Core 1 | 34°53.55'N<br>120°59.06'W | 27763.1<br>42015.3 | 410 | Winds increased to 20 knts. Echnoids and sipunculids in samples. |
| R-9 | 22 Oct 87<br>0943 | Box Core 2 | 34°53.50'N<br>120°59.09'W | 27763.0<br>42015.1 | 410 | First attempt, no trip. Deck washed prior to recovery due to hydraulic fluids. |
| R-9 | 22 Oct 87<br>1148 | Box Core 3 | 34°53.51'N<br>120°59.04'W | 27763.1<br>42015.0 | 410 | Penetration to 22 cm. Raining during sampling. |
| R-9 | 22 Oct 87<br>1049 | Hydrocast | 34°53.52'N<br>120°59.07'W | 27763.0<br>42015.1 | 410 | |
| PJ-1 | Reference Coordinates | | 34°55.65'N<br>120°49.87'W | 27792.5<br>41994.6 | 145 | |
| PJ-1 | 23 Oct 87<br>1311 | Box Core 1 | 34°55.65'N<br>120°49.87'W | 27792.5<br>41994.6 | 145 | Sediment: silty upper, dense lower layers. Penetration to 27 cm. |
| PJ-1 | 23 Oct 87<br>1454 | Box Core 2 | 34°55.63'N<br>120°49.86'W | 27792.5<br>41994.5 | 145 | Penetration to 25 cm. Undisturbed surfaces. |
| PJ-1 | 23 Oct 87<br>1646 | Box Core 3 | 34°55.65'N<br>120°49.87'W | 27792.5<br>41994.6 | 145 | Good sample. |

TABLE 1. SUMMARY OF SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 1 (M/V Aloha) (Continued)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| PJ-1 | 24 Oct 87 0103 | Pore Water Box Core 1 | 34°55.64'N 120°49.86'W | 27792.5 41994.6 | 145 | Excellent sample, undisturbed. |
| PJ-1 | 24 Oct 87 0142 | Pore Water Box Core 2 | 34°55.66'N 120°49.88'W | 27792.5 41994.6 | 145 | Very good sample, little disturbance. |
| PJ-1 | 24 Oct 87 0221 | Pore Water Box Core 3 | 34°55.65'N 120°49.87'W | 27792.4 41994.6 | 145 | Sample slightly disturbed due to rough recovery. |
| PJ-6 | Reference Coordinates | | 34°54.60'N 120°49.86'W | 27792.5 41989.1 | 145 | |
| PJ-6 | 24 Oct 87 0754 | Box Core 1 | 34°54.55'N 120°49.85'W | 27792.5 41988.8 | 145 | Sediment silty; undisturbed surface. |
| PJ-6 | 24 Oct 87 0929 | Box Core 2 | 34°54.57'N 120°49.86'W | 27792.5 41988.9 | 145 | Good sample. |
| PJ-6 | 24 Oct 87 1055 | Box Core 3 | 34°54.60'N 120°49.86'W | 22792.5 41989.1 | 145 | Penetration to 25 cm. |
| PJ-7 | Reference Coordinates | | 34°55.70'N 120°48.57'W | 27796.7 41990.3 | 123 | |
| PJ-7 | 24 Oct 87 0330 | Box Core 1 | 34°55.69'N 120°48.60'W | 27796.6 41990.4 | 123 | Penetration to 25 cm. |
| PJ-7 | 24 Oct 87 0447 | Box Core 2 | 34°55.64'N 120°48.59'W | 27796.7 41990.2 | 123 | High water content in upper layers. |
| PJ-7 | 24 Oct 87 0546 | Box Core 3 | 34°55.70'N 120°48.57'W | 27796.7 41990.3 | 123 | Penetration to 25 cm. |

TABLE 1. SUMMARY OF SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 1 (M/V Aloha) (Continued)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| PJ-8 | Reference Coordinates | | 34°56.76'N 120°49.88'W | 27792.5 42000.4 | 142 | |
| PJ-8 | 23 Oct 87 0334 | Box Core 1 | 34°56.78'N 120°49.94'W | 27792.2 42000.8 | 142 | Good sample. High water content in upper layers. |
| PJ-8 | 23 Oct 87 0455 | Box Core 2 | 34°56.76'N 120°49.84'W | 27792.6 42000.4 | 142 | Undisturbed surfaces. |
| PJ-8 | 23 Oct 87 0633 | Box Core 3 | 34°56.78'N 120°49.87'W | 27792.5 42000.5 | 142 | Penetration to 20 cm. |
| PJ-8 | 26 Oct 87 2127 | Pore Water Box Core 1 | 34°56.73'N 120°49.87'W | 27792.5 42000.3 | 142 | Excellent sample, surfaces undisturbed. Squeezer nearly full. |
| PJ-8 | 26 Oct 87 2157 | Pore Water Box Core 2 | 34°56.77'N 120°49.83'W | 27792.6 42000.3 | 142 | Surfaces slightly disturbed. Squeezer 75 percent full. |
| PJ-8 | 26 Oct 87 2237 | Pore Water Box Core 3 | 34°56.76'N 120°49.89'W | 27792.4 42000.5 | 142 | Undisturbed surfaces. |
| PJ-9 | Reference Coordinates | | 34°55.62'N 120°51.18'W | 27788.2 41999.1 | 169 | |
| PJ-9 | 23 Oct 87 2013 | Box Core 1 | 34°55.63'N 120°51.21'W | 27788.1 41999.1 | 169 | Shallow penetration. Good sample. |
| PJ-9 | 23 Oct 87 2212 | Box Core 2 | 34°55.62'N 120°51.18'W | 27788.3 41999.1 | 169 | Good sample, good penetration. |
| PJ-9 | 23 Oct 87 2256 | Box Core 3 | 34°55.61'N 120°51.21'W | 27788.2 41999.0 | 169 | Penetration to 25 cm. Undisturbed surfaces. |

TABLE 1. SUMMARY OF SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 1 (M/V Aloha) (Continued)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| PJ-10 | Reference Coordinates | | 34°53.53'N<br>120°49.85'W | 27792.5<br>41983.6 | 147 | |
| PJ-10 | 24 Oct 87<br>2223 | Box Core 1 | 34°53.55'N<br>120°49.85'W | 27792.5<br>41983.7 | 147 | First attempt, no-trip. Penetration to 25 cm. Greater than 10 cm fraction - gritty. |
| PJ-10 | 24 Oct 87<br>2337 | Box Core 2 | 34°53.54'N<br>120°49.87'W | 27792.4<br>41983.6 | 147 | Sediment: silty upper layers, dense lower layers. Penetration to 25 cm. |
| PJ-10 | 25 Oct 87<br>0119 | Box Core 3 | 34°53.53'N<br>120°49.87'W | 27792.4<br>41983.5 | 147 | Surface slightly disturbed. Q.C. air sample collected. |
| PJ-10 | 25 Oct 87<br>0700 | Pore Water<br>Box Core 1 | 34°53.54'N<br>120°49.83'W | 27792.6<br>41983.5 | 147 | Three previous attempts unacceptable. Sample partially washed. |
| PJ-10 | 25 Oct 87<br>0735 | Pore Water<br>Box Core 2 | 34°53.54'N<br>120°49.83'W | 27792.6<br>41983.5 | 147 | Sample partially washed. One half of sample was acceptable. |
| PJ-10 | 25 Oct 87<br>0824 | Pore Water<br>Box Core 3 | 34°53.52'N<br>120°49.85'W | 27792.5<br>41983.4 | 147 | One half of sample washed out. |
| PJ-11 | Reference Coordinates | | 34°57.82'N<br>120°49.82'W | 27792.6<br>42006.0 | 136 | |
| PJ-11 | 22 Oct 87<br>2252 | Box Core 1 | 34°57.82'N<br>120°49.87'W | 27792.5<br>42005.9 | 136 | Sediment: Silty upper 4 cm; clay lower layers. |
| PJ-11 | 23 Oct 87<br>0028 | Box Core 2 | 34°57.86'N<br>120°49.88'W | 27792.5<br>42006.2 | 136 | Penetration to 25 cm. Raining lightly. |
| PJ-11 | 23 Oct 87<br>0206 | Box Core 3 | 34°57.90'N<br>120°49.84'W | 27792.6<br>42006.3 | 136 | Undisturbed surfaces, good penetration. |

TABLE 1. SUMMARY OF SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 1 (M/V Aloha) (Continued)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| PJ-11 | 24 Oct 87 1926 | Pore Water Box Core 1 | 34°57.82'N 120°49.82'W | 27792.7 42005.8 | 136 | Slightly disturbed, some overlying water lost prior to collection. |
| PJ-11 | 24 Oct 87 2005 | Pore Water Box Core 2 | 34°57.82'N 120°49.83'W | 27792.6 42005.8 | 136 | Good sample, slightly disturbed. |
| PJ-11 | 24 Oct 87 2039 | Pore Water Box Core 3 | 34°57.81'N 120°49.80'W | 27792.7 42005.7 | 136 | Good surfaces. |
| *PJ-12 | Reference Coordinates | | 34°55.45'N 120°49.83'W | 27792.6 41993.4 | 145 | |
| PJ-12 | 25 Oct 87 0148 | Box Core 1 | 34°55.41'N 120°49.88'W | 27792.5 41993.3 | 145 | Changed clocks to Pacific Standard Time. Penetration to 25 cm. |
| PJ-12 | 25 Oct 87 0311 | Box Core 2 | 34°55.46'N 120°49.85'W | 27792.5 41993.5 | 145 | Undisturbed surfaces. |
| PJ-12 | 25 Oct 87 0424 | Box Core 3 | 34°55.45'N 120°49.83'W | 27792.6 41993.4 | 145 | Sediment: silty surface; dense lower layers. |
| *PJ-13 | Reference Coordinates | | 34°55.83'N 120°49.83'W | 27792.5 41995.6 | 144 | |
| PJ-13 | 25 Oct 87 0918 | Box Core 1 | 34°55.83'N 120°49.87'W | 27792.4 41995.5 | 144 | Many ophiuroids. Penetration to 25 cm. |
| PJ-13 | 25 Oct 87 1039 | Box Core 2 | 34°55.83'N 120°49.89'W | 27792.5 41995.6 | 144 | Good sample. Undisturbed surfaces. |
| PJ-13 | 25 Oct 87 1159 | Box Core 3 | 34°55.83'N 120°49.89'W | 22792.4 41995.6 | 144 | Sediment: silty surface, dense lower layers. |

* Secondary Site-Specifc Station

TABLE 1. SUMMARY OF SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 1 (M/V Aloha) (Continued)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| *PJ-14 | Reference Coordinates | | 34°55.69'N<br>120°49.17'W | 27794.8<br>41992.3 | 134 | |
| PJ-14 | 25 Oct 87<br>1315 | Box Core 1 | 34°55.70'N<br>120°49.13'W | 27794.9<br>41992.3 | 134 | Soft sediment - easy sieving. |
| PJ-14 | 25 Oct 87<br>1425 | Box Core 2 | 34°55.72'N<br>120°49.15'W | 27794.8<br>41992.4 | 134 | Undisturbed surfaces. Penetration to 25 cm. |
| PJ-14 | 25 Oct 87<br>2124 | Box Core 3 | 34°55.69'N<br>120°49.17'W | 27794.7<br>41992.3 | 134 | Good penetration. Good sample. |
| *PJ-15 | Reference Coordinates | | 34°55.63'N<br>120°50.51'W | 27790.5<br>41996.7 | 155 | |
| PJ-15 | 25 Oct 87<br>2246 | Box Core 1 | 34°55.62'N<br>120°50.57'W | 27790.2<br>41996.8 | 155 | Clay balls in 0-10 cm fraction. Penetration to 20 cm. |
| PJ-15 | 26 Oct 87<br>0000 | Box Core 2 | 34°55.63'N<br>120°50.51'W | 27790.4<br>41996.7 | 155 | Sediment: soft upper layer; clay lower layer. |
| PJ-15 | 26 Oct 87<br>0141 | Box Core 3 | 34°55.63'N<br>120°50.52'W | 27790.4<br>41996.7 | 155 | High noise ratio on LORAN. Subcore No. 20 for HC. |

* Secondary Site-Specific Station

TABLE 1. SUMMARY OF SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 1 (M/V Aloha) (Continued)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| *PJ-16 | Reference Coordinates | | 34°54.95'N 120°48.94'W | 27795.5 41987.7 | 130 | |
| PJ-16 | 26 Oct 87 0350 | Box Core 1 | 34°54.91'N 120°48.92'W | 27795.6 41987.4 | 130 | Two previous attempts - wash-out and no-trip. Penetration to 14 cm. Some alternate cores used. |
| PJ-16 | 26 Oct 87 0459 | Box Core 2 | 34°54.90'N 120°48.98'W | 27795.3 41987.6 | 130 | First attempt, no-trip. Compact lower layers. Some alternates used. |
| PJ-16 | 26 Oct 87 0557 | Box Core 3 | 34°54.95'N 120°48.94'W | 27795.5 41987.7 | 130 | Killer moths. Sediment held better than last replicates. Patchy base. |
| *PJ-17 | Reference Coordinates | | 34°56.43'N 120°48.91'W | 27795.6 41995.4 | 126 | |
| PJ-17 | 26 Oct 87 0755 | Box Core 1 | 34°56.46'N 120°48.93'W | 27795.5 41995.7 | 126 | Good sample. Penetration to 20 cm. Undisturbed surfaces. |
| PJ-17 | 26 Oct 87 0914 | Box Core 2 | 34°56.46'N 120°48.91'W | 27795.6 41995.5 | 126 | Much macrofauna obvious; echinoids, ophiuroids, polychaetes. |
| PJ-17 | 26 Oct 87 1046 | Box Core 3 | 34°56.43'N 120°48.91'W | 27795.6 41995.4 | 126 | Sediments: silty upper layers. |

* Secondary Site-Specific Station

TABLE 1. SUMMARY OF SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 1 (M/V Aloha) (Continued)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| *PJ-18 | Reference Coordinates | | 34°56.42'N<br>120°50.80'W | 27789.5<br>42001.9 | 158 | |
| PJ-18 | 26 Oct 87<br>1233 | Box Core 1 | 34°56.43'N<br>120°50.76'W | 27789.6<br>42001.9 | 158 | Three previous attempts, no-trips. Penetration to 25 cm. Surfaces slightly disturbed. |
| PJ-18 | 26 Oct 87<br>1338 | Box Core 2 | 34°56.42'N<br>120°50.77'W | 27789.6<br>42001.9 | 158 | Delayed recovery to avoid oiled deck wash off stern. Slight disturbance. |
| PJ-18 | 26 Oct 87<br>1431 | Box Core 3 | 34°56.43'N<br>120°50.78'W | 27789.5<br>42001.9 | 159 | Penetration to 25 cm. Swells increasing slightly. |
| *PJ-19 | Reference Coorindates | | 34°54.92'N<br>120°50.76'W | 27789.6<br>41993.8 | 167 | |
| PJ-19 | 26 Oct 87<br>1734 | Box Core 1 | 34°54.89'N<br>120°50.77'W | 27789.6<br>41993.7 | 167 | Good surfaces. Penetration to 25 cm. Heavy rain. |
| PJ-19 | 26 Oct 87<br>1848 | Box Core 2 | 34°54.92'N<br>120°50.76'W | 27789.6<br>41993.9 | 167 | Penetration > 25 cm. |
| PJ-19 | 26 Oct 87<br>2001 | Box Core 3 | 34°54.88'N<br>120°50.78'W | 27789.6<br>41993.7 | 167 | Penetration > 25 cm. Undisturbed. |

* Secondary Site-Specific Station

TABLE 1. SUMMARY OF SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 1 (M/V Aloha) (Continued)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| *PJ-20 | Reference Coordinates | | 34°50.39'N<br>120°49.82'W | 27792.5<br>41967.2 | 148 | |
| PJ-20 | 27 Oct 87<br>0322 | Box Core 1 | 34°50.38'N<br>120°49.80'W | 27792.6<br>41967.0 | 148 | Sediment; granular. Penetration to 15 cm. |
| PJ-20 | 27 Oct 87<br>0419 | Box Core 2 | 34°50.36'N<br>120°49.81'W | 27792.6<br>41967.0 | 148 | Penetration to 15 cm. Marginal sample due to high sand content. |
| PJ-20 | 27 Oct 87<br>0633 | Box Core 3 | 34°50.38'N<br>120°49.85'W | 27792.4<br>41967.2 | 148 | First attempt; no-trip, winch wire wrapped around corer. Shallow penetration, lower layers sandy. |
| *PJ-21 | Reference Coordinates | | 35°01.00'N<br>120°51.16'W | 27788.3<br>42027.2 | 143 | |
| PJ-21 | 26 Oct 87<br>2343 | Box Core 1 | 35°01.00'N<br>120°51.16'W | 27788.3<br>42027.2 | 143 | Rough recovery. Good sample. Undisturbed surfaces. |
| PJ-21 | 27 Oct 87<br>0047 | Box Core 2 | 35°00.96'N<br>120°51.17'W | 27788.2<br>42027.1 | 143 | Sediment: silty upper, clay lower layers. Jelly fish present in cores. |
| PJ-21 | 27 Oct 87<br>0152 | Box Core 3 | 35°00.98'N<br>120°51.19'W | 27788.2<br>42027.3 | 143 | Much detritus in sample. Jelly fish in some cores. |

* Secondary Site-Specific Station

TABLE 1. SUMMARY OF SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 1 (M/V Aloha) (Continued)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| PJ-22 | Reference Coordinates | | 34°55.13'N<br>120°49.86'W | 27792.5<br>41991.9 | 143 | |
| PJ-22 | 24 Oct 87<br>1432 | Box Core 1 | 34°55.13'N<br>120°49.89'W | 27792.4<br>41992.0 | 143 | Deck washed prior to deployment. Penetration to 20 cm. Undisturbed surfaces. |
| PJ-22 | 24 Oct 87<br>1540 | Box Core 2 | 34°55.13'N<br>120°49.86'W | 27792.5<br>41991.9 | 143 | Slightly disturbed bed, used an alternate for sedimentology. |
| PJ-22 | 24 Oct 87<br>1657 | Box Core 3 | 34°55.13'N<br>120°49.88'W | 27792.4<br>41991.9 | 143 | Penetration to 20 cm. Undisturbed cores. |
| PJ-23 | Reference Coordinates | | 34°56.16'N<br>120°49.86'W | 27792.5<br>41997.3 | 143 | |
| PJ-23 | 23 Oct 87<br>0833 | Box Core 1 | 34°56.16'N<br>120°49.86'W | 27792.5<br>41997.3 | 143 | Soft green mud. Undisturbed surfaces. |
| PJ-23 | 23 Oct 87<br>0958 | Box Core 2 | 34°56.18'N<br>120°49.86'W | 27792.5<br>41997.4 | 143 | Penetration to 30 cm. High water content throughout cores. |
| PJ-23 | 23 Oct 87<br>1128 | Box Core 3 | 34°56.16'N<br>120°49.89'W | 27792.4<br>41997.3 | 143 | Good sample. Penetration to 25 cm. |

TABLE 2. SUMMARY OF ANIMAL TRAP POSITIONS ON CRUISE CAMP 2-3, LEG 1 (M/V Aloha)

| Station | Date and Time (PDT/PST) | Sample | Latitude Longitude | LORAN Time Delays | Depth (M) | Comments |
|---|---|---|---|---|---|---|
| R-2 | 21 Oct 87 2301 | Animal Traps Deployed | 35°05.19'N 120°53.35'W | 27781.0 42057.1 | 161 | High flyer in water. Bait: Pre-thawed chicken, cat food and fish scraps. |
| R-2 | 24 Oct 87 1243 | Animal Traps Recovered | 35°05.03'N 120°53.68'W | 27780.0 42057.4 | | Trap catch: 1 large Pleurobranchea. Fish not retained. Octopii fell on deck. |
| PJ-1 | 24 Oct 87 1414 | Animal Traps Deployed | 34°55.62'N 120°49.87'W | 27792.5 41994.5 | 145 | High flyer in water. Same bait as used at R-2. |
| PJ-1 | 26 Oct 87 1600 | Animal Traps Recovered | 34°55.65'N 120°49.95'W | 27792.2 41994.8 | | Trap catch: 12 Pleurobranchea, 1 Asteroidea. Octopii dropped on deck. Several fish also present. |
| PJ-11 | 24 Oct 87 2144 | Animal Traps Deployed | 34°57.80'N 120°49.97'W | 27792.2 42006.2 | 136 | High flyer in water. Typical bait. |
| PJ-11 | 26 Oct 87 1600 | Animal Traps Recovered | 34°57.87'N 120°49.88'W | 27792.5 42006.3 | | Trap catch: 1 Pleurobranchea, 1 Cancer, sand dabs, hag fish. |

# APPENDIX B

TABLE 1. SUMMARY OF GRAB SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 3 (M/V Aloha)

| Station | Date and Time (PST) | Sample | Latitude Longitude | UTM Coordinates | Comments |
|---|---|---|---|---|---|
| PH-E | Reference Coordinates | | 34°30.19'N<br>120°42.68'W | N3820125<br>E710125 | Depth 119 m. |
| PH-E | 05 Nov 87<br>2200 | Grab 1 | 34°30.18'N<br>120°42.68'W | N3820121<br>E710116 | Undisturbed surface. |
| PH-E | 05 Nov 87<br>2220 | Grab 2 | 34°30.19'N<br>120°42.68'W | N3820124<br>E710124 | Good surface. |
| PH-E | 05 Nov 87<br>2240 | Grab 3 | 34°30.19'N<br>120°42.68'W | N3820127<br>E710127 | Good surface. |
| PH-F | Reference Coordinates | | 34°30.79'N<br>120°42.52'W | N3821250<br>E710350 | Depth 105 m. |
| PH-F | 05 Nov 87<br>2102 | Grab 1 | 34°30.79'N<br>120°42.52'W | N3821254<br>E710349 | Excellent surface. |
| PH-F | 05 Nov 87<br>2118 | Grab 2 | 34°30.79'N<br>120°42.52'W | N3821255<br>E710346 | Excellent surface. |
| PH-F | 05 Nov 87<br>2135 | Grab 3 | 34°30.79'N<br>120°42.51'W | N3821253<br>E710352 | Excellent surface, undisturbed. |

TABLE 1. SUMMARY OF GRAB SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 3 (M/V Aloha) (Continued)

| Station | Date and Time (PST) | Sample | Latitude Longitude | UTM Coordinates | Comments |
|---|---|---|---|---|---|
| PH-I | Reference Coordinates | | 34°29.98'N<br>120°41.70'W | N3819770<br>E711629 | Depth 107 m. |
| PH-I | 06 Nov 87<br>0839 | Grab 1 | 34°29.97'N<br>120°41.73'W | N3819759<br>E711594 | Repeated attempts hit rocky bottom.<br>Excellent surface. |
| PH-I | 06 Nov 87<br>1001 | Grab 2 | 34°29.95'N<br>120°41.74'W | N3819721<br>E711572 | Repeated attempts hit rocky bottom.<br>Good surface. |
| PH-I | 06 Nov 87<br>1021 | Grab 3 | 34°29.95'N<br>120°41.74'W | N3819727<br>E711568 | Good surface |
| PH-J | Reference Coordinates | | 34°29.83'N<br>120°41.86'W | N3819500<br>E711400 | Depth 117 m. |
| PH-J | 06 Nov 87<br>1054 | Grab 1 | 34°29.83'N<br>120°41.86'W | N3819497<br>E711396 | Surface in contact with grab lid. Soft sediment. Q.C. air sample. |
| PH-J | 06 Nov 87<br>1114 | Grab 2 | 34°29.84'N<br>120°41.86'W | N3819509<br>E711399 | Good surface. |
| PH-J | 06 Nov 87<br>1132 | Grab 3 | 34°29.84'N<br>120°41.86'W | N3819504<br>E711400 | Good surface. |

TABLE 1. SUMMARY OF GRAB SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 3 (M/V Aloha)(Continued)

| Station | Date and Time (PST) | Sample | Latitude Longitude | UTM Coordinates | Comments |
|---|---|---|---|---|---|
| PH-K | Reference Coordinates | | 34°29.41'N<br>120°42.29'W | N3818700<br>E710750 | Depth 160 m. |
| PH-K | 06 Nov 87<br>1704 | Grab 1 | 34°29.41'N<br>120°42.29'W | N3818704<br>E710754 | Good surface. |
| PH-K | 06 Nov 87<br>1721 | Grab 2 | 34°29.41'N<br>120°42.29'W | N3818697<br>E710755 | Good surface. Echinoid removed from sample. |
| PH-K | 06 Nov 87<br>1740 | Grab 3 | 34°29.41'N<br>120°42.29'W | N3818696<br>E710750 | Good sample. |
| PH-N | Reference Coordinates | | 34°29.24'N<br>120°42.10'W | N3818400<br>E711050 | Depth 166 m. |
| PH-N | 06 Nov 87<br>1351 | Grab 1 | 34°29.24'N<br>120°42.11'W | N3818403<br>E711043 | Good surface. |
| PH-N | 06 Nov 87<br>1418 | Grab 2 | 34°29.24'N<br>120°42.10'W | N3818401<br>E711046 | Good surface. |
| PH-N | 06 Nov 87<br>1439 | Grab 3 | 34°29.25'N<br>120°42.10'W | N3818411<br>E711056 | Good surface. |

TABLE 1. SUMMARY OF GRAB SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 3 (M/V Aloha) (Continued)

| Station | Date and Time (PST) | Sample | Latitude Longitude | UTM Coordinates | Comments |
|---|---|---|---|---|---|
| PH-R | Reference Coordinates | | 34°29.17'N<br>120°42.46'W | N3818250<br>E710500 | Depth 213 m. |
| PH-R | 06 Nov 87<br>1230 | Grab 1 | 34°29.18'N<br>120°42.46'W | N3818272<br>E710498 | Excellent sample. Overlying water siphoned off. |
| PH-R | 06 Nov 87<br>1255 | Grab 2 | 34°29.17'N<br>120°42.48'W | N3818244<br>E710479 | Good surface. |
| PH-R | 06 Nov 87<br>1320 | Grab 3 | 34°29.17'N<br>120°42.47'W | N3818249<br>E710494 | Good surface. |
| PH-U | Reference Coordinates | | 34°31.42'N<br>120°43.47'W | N3822370<br>E708870 | Depth 113 m. |
| PH-U | 05 Nov 87<br>1945 | Grab 1 | 34°31.42'N<br>120°43.47'W | N3822367<br>E708864 | Marginal sample with surface disturbance. |
| PH-U | 05 Nov 87<br>2006 | Grab 2 | 34°31.42'N<br>120°43.47'W | N3822374<br>E708866 | Overlying water, good sample. |
| PH-U | 05 Nov 87<br>2032 | Grab 3 | 34°31.41'N<br>120°43.47'W | N3822362<br>E708857 | Undisturbed surface. |

TABLE 1. SUMMARY OF GRAB SAMPLE POSITIONS ON MMS CRUISE CAMP 2-3, LEG 3 (M/V Aloha) (Continued)

| Station | Date and Time (PST) | Sample | Latitude Longitude | UTM Coordinates | Comments |
|---|---|---|---|---|---|
| PH-W | Reference Coordinates | | 34°31.58'N<br>120°45.69'W | N3822591<br>E705464 | Depth 195 m. |
| PH-W | 05 Nov 87<br>1734 | Grab 1 | 34°31.58'N<br>120°45.68'W | N3822598<br>E705468 | First two attempts; pre-trips. |
| PH-W | 05 Nov 87<br>1758 | Grab 2 | 34°31.58'N<br>120°45.68'W | N3822595<br>E705468 | Surface slightly disturbed. |
| PH-W | 05 Nov 87<br>1902 | Grab 3 | 34°31.57'N<br>120°45.69'W | N3822579<br>E705467 | Disturbed surface areas avoided during sample collection. |

TABLE 2. SUMMARY OF ANIMAL TRAP POSITIONS ON MMS CRUISE CAMP 2-3, LEG 3 (M/V Aloha)

| Station | Date and Time (PST) | Phase | Latitude Longitude | UTM Coordinates | Comments |
|---|---|---|---|---|---|
| PHA-1 | Reference Coordinates | | 34°29.89'N<br>120°42.37'W | N3819592<br>E710611 | Reference changed to 500 m N.W. of Platform Hidalgo to avoid platform traffic. |
| PHA-1 | 4 Nov 87<br>1740 | Animal Traps Deployed | 34°29.87'N<br>120°42.37'W | N3819552<br>E710611 | High flyer in water. Bait: chicken, cat food, and fish scraps. |
| PHA-1 | 6 Nov 87<br>1630 | Animal Traps Recovered | not noted | not noted | Trap catch: 2 Cancer, 6 Pleurobranchea, 1 Portunid, 4 Rathbunaster, 1 Pycnopodia. |
| PHA-2 | Reference Coordinates | | 34°30.08'N<br>120°42.60'W | N3819938<br>E710249 | |
| PHA-2 | 4 Nov 87<br>0939 | Animal Traps Deployed | 34°30.26'N<br>120°42.12'W | N3820289<br>E710971 | High flyer in water. Bait: chicken, cat food, and fish scraps. |
| PHA-2 | 6 Nov 87<br>1615 | Animal Traps Recovered | not noted | not noted | Trap catch: 6 Cancer, 2 Pleurobranchea, 5 Asteriodea. 1 km due north of Hidalgo. |
| PHA-3 | Reference Coordinates | | 34°31.23'N<br>120°43.99'W | N3822011<br>E708080 | |
| PHA-3 | 4 Nov 87<br>1036 | Animal Traps Deployed | 34°31.23'N<br>120°44.06'W | N3822010<br>E707979 | High flyer in water. Bait: chicken, cat food, and fish scraps. |
| PHA-3 | 6 Nov 87<br>1530 | Animal Traps Recovered | not noted | not noted | Trap catch: 1 Cancer, 2 Pleurobranchea, 3 Asteroidea. Octopii dropped on deck. Flatfish in traps. |

# APPENDIX C

FORM APPROVED: OMB NO. 41-R2765 – EXPIRES : 12-31-79

NOAA FORM 24-23
(1-76)

U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
ENVIRONMENTAL DATA SERVICE
NATIONAL OCEANOGRAPHIC DATA CENTER

A00 DATA CENTER

A40 REFERENCE NUMBER

# OCEANOGRAPHY – GENERAL CRUISE INVENTORY
(ROSCOP – II)

A01 EXPEDITION/PROJECT
California OCS Phase II Monitoring Program

A11 CRUISE NUMBER OR NAME
CAMP 2-3, Legs 1, 2, and 3

A02 SHIP OR PLATFORM
M/V Aloha

A12 PLATFORM TYPE
01

A03 COUNTRY | A04 ORGANIZATION

| | YES | NO | PART | |
|---|---|---|---|---|
| A91 Declared national program? | X | | | |
| A81 Exchange restricted? | | X | | |
| A92 Co-operative program? | | X | | A72 NAME |
| A82 Co-ordinated internationally? | | X | | A62 BY WHOM? |

A05 CHIEF SCIENTIST(S) J. F. Campbell, Battelle
B. Butman, U.S.G.S.
D. Hardin, Kinnetics

A06 NAME AND ADDRESSES OF ORGANIZATIONS AND PERSONS WHOM TO QUERY

| | FINAL DISPOSITION OF DATA |
|---|---|
| A1 J. L. Hyland, Battelle, Ventura, CA | A2 J. L. Hyland |
| B1 P. D. Boehm, Battelle, Duxbury, MA | B2 Program Manager |
| C1 E. Crecelius, Battelle, Sequim, WA | C2 Battelle Ocean Sciences |
| D1 P. Kinney, Kinnetics, Santa Cruz, CA | D2 1431 Spinnaker Drive |
| E1 L. Watling, Univ. of Maine, Walpole, ME | E2 Ventura, CA 93001 |

| DATE | DAY | MONTH | YEAR |
|---|---|---|---|
| A07 FROM | 19 | 10 | 87 |
| A17 TO | 12 | 11 | 87 |

A08 GENERAL OCEAN AREAS
57A NE Pacific Ocean 121°W

A09 TYPE(S) OF MARINE ZONE(S)
07,08

GEOGRAPHIC AREA
*If all data were collected at a fixed station, fill in the co-ordinates*

A10 LATITUDE ° ' " N/S

A20 LONGITUDE ° ' " E/W

A15 FEDERAL SUPPORT U. S. D. I. - Minerals Management Service

A25 REMARKS F1 - B. Butman, U.S.G.S., Woods Hole, MA
F2 - J. L. Hyland, Battelle, Ventura, CA
GU - Measurements underway. All photographs and motion pictures were taken by cameras attached to a Remotely Operated Vehicle (ROV).
Sediment Collection: 28 stations sampled by 0.25m$^2$ box core
9 stations sampled by 0.1m$^2$ grab sampler

| DISCIPLINE AND TYPE OF MEASUREMENTS | Index 10° x 10° Qc | L | G | G | INDEX 1° x 1° | DISCIPLINE AND TYPE OF MEASUREMENTS | Index 10° x 10° Qc | L | G | G | INDEX 1° x 1° |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A GU, GS, D B | 7 | 3 | 1 | 2 | | A B | | | | | |
| A H(NSF), HP B | 7 | 3 | 1 | 2 | | A B | | | | | |
| A HC, P, B, BS B | 7 | 3 | 1 | 2 | | A B | | | | | |
| A B | | | | | | A B | | | | | |
| A B | | | | | | A B | | | | | |
| A B | | | | | | A B | | | | | |
| A B | | | | | | A B | | | | | |

## G – GEOLOGY GEOPHYSICS

| GL MEASUREMENTS MADE AT A SPECIFIC LOCATION | NUMBER | i | I | FORMAT |
|---|---|---|---|---|
| G01 Dredge | | | | |
| G02 Grab | | | | |
| G03 Core rock *(no. of cores)* | | | | |
| G04 Core–soft bottom *(no. of cores)* | | | | |
| G05 Sampling by divers | | | | |
| G06 Sampling by submersible | | | | |
| G07 Drilling | | | | |
| G08 Bottom photography | | | | |
| G09 Sea floor temperature *(≤ 1 m from bottom)* | | | | |
| G10 Accoustical properties of the sea floor | | | | |
| G11 Engineering properties of the sea floor | | | | |
| G12 Magnetic properties of the sea floor | | | | |
| G13 Gravimetric properties of the sea floor | | | | |
| G14 Radioactivity measurements | | | | |
| G70 Other measurements | | | | |
| | | | | |
| | | | | |

| GU MEASUREMENTS UNDERWAY | | | | |
|---|---|---|---|---|
| G21 Motion picture of sea floor *(No. of nautical miles)* Approx. | 5 | D 1 | A 2 | 8 |
| G22 Bathymetry-wide beam *(no. of nautical miles)* | | | | |
| G23 Bathymetry-narrow beam *(no. of nautical miles)* | | | | |
| G24 Side scan sonor *(no. of nautical miles)* Approx. | 28 | F 1 | A 2 | 3 |
| G25 Seismic reflection *(no. of nautical miles)* | | | | |
| G26 Seismic refraction *(no. of nautical miles)* | | | | |
| G27 Gravimetry | | | | |
| G28 Magnetism | | | | |
| G29 Other measurements | | | | |
| Bottom Photographs | 9 | D 1 | A 2 | 8 |
| | | | | |
| | | | | |
| | | | | |

## G – GEOLOGY GEOPHYSICS *(Continued)*

| GS TYPES OF STUDIES | NUMBER | i | I | FORMAT |
|---|---|---|---|---|
| G31 Physical analysis of sediments | 37 | D 1 | A 2 | 9 |
| G32 Chemical analysis of sediments | 37 | DC 11 | A 2 | 9 |
| G33 Paleothermy | | | | |
| G34 Paleomagnetism and rock magnetism | | | | |
| G35 Paleontology | | | | |
| G36 Geothermy | | | | |
| G37 Geochronology | | | | |
| G38 Mineral and fossil resources | | | | |
| G39 Litteral zone studies | | | | |
| G90 Other measurements | | | | |

## D – DYNAMICS

| | | | | |
|---|---|---|---|---|
| D01 Current meters *(no. of stat.)* | 2 | D 1 | A 2 | 7 |
| D02 Current meters *(Average duration of measurement days)* | | | | |
| D03 Currents measured from ship drift | | | | |
| D04 GEK | | | | |
| D05 Drifters *(number)* | | | | |
| D06 Swallow floats *(number)* | | | | |
| D07 Drift cards *(no. released)* | | | | |
| D08 Bottom drifters *(no. released)* | | | | |
| D09 Tidal observation *(duration)* | | | | |
| D10 Sea and swell *(no. of observations)* | | | | |
| D90 Other measurements | | | | |
| | | | | |

## M – METEOROLOGY

| | | | | |
|---|---|---|---|---|
| M01 Upper air observations | | | | |
| M02 Incident radiation | | | | |
| M03 Air–sea interface studies | | | | |
| M04 Ice observations | | | | |
| M05 Occasional standard measurements | | | | |
| M06 Systematic standard measurements | | | | |
| M90 Other measurements | | | | |
| | | | | |

Battelle
Ocean Sciences - Ventura Operations
1431 Spinnaker Drive
Ventura, CA 93001
Telephone (805) 658-8677
Telecopy (805) 658-8622

December 10, 1987

Mr. Nelson Ross
National Oceanographic Data Center
P. O. Box 571
La Jolla, CA 92038

Dear Mr. Ross:

Enclosed please find the ROSCOP Oceanography General Cruise Inventory of the Minerals Management Service's California OCS Phase II Monitoring Program Cruise CAMP 2-3, Legs 1, 2, and 3.

Sincerely yours,

James F. Campbell

James F. Campbell
Chief Scientist

Approved:

Jeffrey L. Hyland

Jeffrey L. Hyland, Ph.D.
Program Manager

JFC/hms

Enclosure

cc: Dr. Gary Brewer, MMS
Ms. Frances Sullivan, MMS
Dr. Donald Aurand, MMS

## H– HYDROGRAPHY

| HS SURFACE | NUMBER | i | l | FORMAT |
|---|---|---|---|---|
| H01 Continuous temperature recording | | | | |
| H02 Continuous salinity recording | | | | |
| H03 Discrete temperature measurements | | | | |
| H04 Discrete salinity measurements | | | | |
| **NEAR SEA FLOOR (≤ 10 m)** | | | | |
| H05 Continuous temperature recording | | | | |
| H06 Continuous salinity recording | | | | |
| H07 Discrete temperature measurements | 13 | D 1 | A 2 | 9 |
| H08 Discrete salinity measurements | 13 | D 1 | A 2 | 9 |
| **HP PHYSICAL** | | | | |
| H09 Classical oceanographic stations | | | | |
| H10 Vertical profiles (STD/CTD) | 4 | D 1 | A 2 | 7 |
| H11 Sub–surface measurements underway | | | | |
| H12 Mechanical bathythermograph (No. of drops) | | | | |
| H13 Bathythermograph–expendable (No. of drops) | | | | |
| H14 Sound velocity stations | | | | |
| H15 Acoustic stations | | | | |
| H16 Transparency | | | | |
| H17 Optics | | | | |
| H18 Diffusion (Dynamic) | | | | |
| H80 Other measurements | | | | |
| | | | | |
| | | | | |
| | | | | |
| **HC CHEMICAL** | | | | |
| H21 Oxygen | 13 | D 1 | A 2 | 9 |
| H22 Phosphates | | | | |
| H23 Total–P | | | | |
| H24 Nitrates | | | | |
| H25 Nitrites | | | | |

| HC CHEMICAL | NUMBER | i | l | FORMAT |
|---|---|---|---|---|
| H26 Silicates | | | | |
| H27 Alkalinity | | | | |
| H28 pH | | | | |
| H29 Chlorinity | | | | |
| H30 Trace elements | | | | |
| H31 Radioactivity | | | | |
| H32 Isotopes Pb/Th in sediment | 5 | C 1 | A 2 | 9 |
| H33 Dissolved gases | | | | |
| H90 Other measurements | | | | |
| | | | | |
| | | | | |

| P – POLLUTION | | | | |
|---|---|---|---|---|
| P01 Suspended solids | | | | |
| P02 Heavy metals in sediment | 37 | C 1 | A 2 | 9 |
| P03 Petroleum residues | 37 | B 1 | A 2 | 9 |
| P04 Chlorinated hydrocarbons | | | | |
| P05 Other dissolved substances | | | | |
| P06 Thermal pollution | | | | |
| P07 Waste water: BOD | | | | |
| P08 Waste water: Nitrates | | | | |
| P09 Waste water: Microbiology | | | | |
| P10 Waste water: Other | | | | |
| P11 Discolored water | | | | |
| P12 Bottom deposits | | | | |
| P13 Contaminated organisms | | | | |
| P90 Other measurements | | | | |
| Heavy metals in pore water | 4 | C 1 | A 2 | 9 |
| Petroleum residues in pore water | 4 | B 1 | A 2 | 9 |
| Heavy metals in organisms | 4 | C 1 | A 2 | 9 |
| Petroleum residues in organisms | 6 | B 1 | A 2 | 9 |

## B – BIOLOGY

| | NUMBER | i | l | FORMAT |
|---|---|---|---|---|
| B01 Primary productivity | | | | |
| B02 Phytoplankton pigments | | | | |
| B03 Seston | | | | |
| B04 Particulate organic carbon | | | | |
| B05 Particulate organic nitrogen | | | | |
| B06 Dissolved organic matter | | | | |
| B07 Bacterial and pelagic micro–organisms | | | | |
| B08 Phytoplankton | | | | |
| B09 Zooplankton | | | | |
| B10 Neuston | | | | |
| B11 Nekton | | | | |
| B12 Invertebrate nekton | | | | |
| B13 Pelagic eggs and larvae | | | | |
| B14 Pelagic fish | | | | |
| B15 Amphibians | | | | |
| B16 Benthic bacteria and micro–organisms | | | | |
| B17 Phytobenthos | | | | |
| B18 Zoobenthos | 28 | A 1 | A 2 | 9 |
| B19 Commercial demersal fish | | | | |
| B20 Commercial benthic molluscs | | | | |
| B21 Commercial benthic crustacean | | | | |
| B22 Attached plants and algae | | | | |
| B23 Intertidal organisms | | | | |
| B24 Borers and foulers | | | | |
| B25 Birds | | | | |
| B26 Mammals and reptiles | | | | |
| B27 Deep scattering layers | | | | |
| B28 Acoustical reflections on marine organisms | | | | |
| B29 Biologic sounds | | | | |
| B30 Bioluminescence | | | | |

| | NUMBER | i | l | FORMAT |
|---|---|---|---|---|
| B31 Vitamin concentrations | | | | |
| B32 Amino acid concentration | | | | |
| B33 Hydrocarbon concentrations | | | | |
| B34 Lipid concentrations | | | | |
| B35 ATP–ADP–AMP concentrations | | | | |
| B36 DNA–RNA concentrations | | | | |
| B37 Taggings | | | | |
| B80 Other measurements | | | | |
| Sediment X-Rays | 14 | E 1 | A 2 | 8 |
| **B5 TYPES OF STUDIES** | | | | |
| B51 Identification | 28 | A 1 | A 2 | 9 |
| B52 Spatial and temporal distribution | 28 | A 1 | A 2 | 9 |
| B53 Monitoring and surveillance | 28 | A 1 | A 2 | 9 |
| B54 Biomass determination | | | | |
| B55 Description of communities | 28 | A 1 | A 2 | 9 |
| B56 Food chains energy transfers | | | | |
| B57 Population and environments | 28 | A 1 | A 2 | 9 |
| B58 Population structures | 28 | A 1 | A 2 | 9 |
| B59 Taxonomy, systematics, classification | 28 | A 1 | A 2 | 9 |
| B60 Physiology | | | | |
| B61 Behaviour | | | | |
| B62 Pathology, parasitology | | | | |
| B63 Toxicology | | | | |
| B64 Gear research | | | | |
| B65 Exploratory fishing | | | | |
| B66 Commercial fishing | | | | |
| B67 Aquaculture | | | | |
| B90 Other measurements | | | | |



☆ U.S. Government Printing Office: 1979—668-080

December 9, 1987

Dr. Gary Brewer
U. S. Department of Interior
Minerals Management Service
Pacific OCS Office
1340 West Sixth Street
Los Angeles, CA 90017

Re: **MMS Contract No. 14-12-0001-30262** (Combined Monthly Progress Report for October and November, 1987)

Dear Gary:

This report summarizes technical progress accomplished and costs incurred during the months of October and November, 1987, for the program entitled "Monitoring: Assessment of Long-Term Changes in Biological Communities, Phase II." Technical progress is reported in the paragraphs below. Summaries of costs and labor are provided in the two attached tables.

October and November were particularly busy months because of the combined effects of meetings, two major cruises, commitments to setting up the Pac Baroness study, and routine technical and administrative activities. Management activities focused on (1) planning and coordination of MMS Cruise CAMP 2-3 (Legs 1 to 3); (2) planning and coordination of the Pac Baroness cruise; (3) planning and conduct of the First Annual Progress Meeting (November 12 to 13, 1987); (4) initiating plans for producing the final version of the Year-One Annual Progress Report; (5) providing general technical direction for various task areas; and (6) performance of routine day-to-day administrative responsibilities (e.g., trouble-shooting, cost-tracking, quality surveillance, and dissemination of information pertaining to the Monitoring Program).

At the First Annual Progress Meeting, we discussed plans for revising our sampling designs to accommodate delays in drilling, at both Platforms Hidalgo (hard-bottom sampling area) and Julius (soft-bottom sampling area). These technical revisions require a re-distribution of funds among tasks and project years. Because of these revisions, a revised cost proposal will be submitted in response to MMS request by January 29, 1988. Further detials on the nature of the technical changes are discussed below in the section on meetings.

## Sampling

There were two major cruises conducted during October and November. The first cruise, MMS Cruise CAMP 2-3, was conducted 19 October through 12 November, 1987. This cruise consisted of three separate legs identified as follows (mobilization/demobilization days included):

- Leg 1 - Soft-bottom box coring (19-29 October, 1987)

- Leg 2 - Second follow-up instrument retrieval cruise for the USGS sediment-transport task (31 October - 3 November, 1987)

- Leg 3 - Hard-bottom photosurvey and physical oceanography leg (3-12 November, 1987).

The objectives of Leg 1 were to (1) collect three replicate box cores at each of 28 stations (9 regionals plus 19 site-specific stations); (2) collect three replicate box cores for pore-water chemistry at four selected primary site-specific stations (PJ-1, PJ-8, PJ-10, and PJ-11); (3) collect replicate animal-tissue samples at three selected stations (R-2, PJ-1, and PJ-11); and (4) perform a single hydrocast (for near-bottom measurements of dissolved oxygen, salinity, and temperature) at each of the nine regional stations. All major Leg-1 objectives were accomplished ahead of schedule, and the ship returned to port a day early.

The primary objective of Leg 2 was to attempt to locate and recover a current-meter mooring deployed at 34°53.7'N, 120°59.5'W (near Regional Station R-9) in about 400 m of water. This mooring, containing three EG&G vector-averaging current meters, was deployed in May, 1987, as part of the USGS Sediment-Transport Task, and was to be recovered in July, 1987. No attempt could be made to recover or interrogate the mooring on the originally scheduled July cruise because of heavy weather and ship equipment failures. Recovery was re-scheduled for a September follow-up cruise, at which time recovery attempts were possible, however, the mooring did not respond to any acoustic commands. It was assumed at that time that either the release had failed or that the mooring was dragged away as a result of fishing activity. Because of the value of the equipment and importance of the data, the second follow-up leg was planned. Search and recovery attempts on this leg incorporated searches of the surrounding area with acoustic release gear, a side-scan sonar with an EG&G 50 Khz system, and a remotely operated vehicle (ROV) equipped with Mesotech sonar. Search attempts were completed with all gear types, however, none of these techniques were able to locate the mooring. Side-scan images did reveal extensive trawl marks throughout the region, especially at the depth range of the mooring. Based on these searches, it is concluded that the mooring is lost, and that the most probable cause of loss is an accidental encounter with fishing gear.

Objectives of Leg 3 were to (1) sample replicate 70-mm photoquadrats of each high-relief location (three) and each low-relief location (eight) within the Platform Hidalgo study area; (2) collect three replicate grab samples of sediment for analysis of trace metals, hydrocarbons, and sedimentology parameters from nine Platform Hidalgo stations (coinciding with photo stations); (3) collect replicate animal-tissue samples at three selected Platform Hidalgo stations; (4) retrieve, service, and redeploy current meters at the Platform Hidalgo and Julius physical-oceanography sites; and (5) obtain water-quality profiles and hydrographic casts from each of two locations within the Platform Hidalgo and Julius study areas. All sampling objectives were accomplished within schedule. Inspection of the current-meter mooring and telemetry system at Station PJ-13A near Platform Julius, however, revealed that the mooring had been hit by some object and that the acoustic release was missing. Remaining components of the mooring and telemetry system were present and current meters are obtaining data.

Further details on the results of MMS Cruise CAMP 2-3 will appear in the Cruise Report, submitted under separate cover.

The second cruise conducted during the current reporting period was the Pac Baroness Cruise. This sampling effort and subsequent related analytical activities are being supported through a contract modification to the ongoing CAMP program. This study is of importance with respect to the CAMP program because results will be used to evaluate whether potential impacts linked to the sinking of the Pac Baroness will interfere with efforts to detect drilling-related impacts at nearby monitoring stations (nearest stations are about 10 miles to the NNW). A brief account of the progress and preliminary observations regarding the Pac Baroness survey is provided as Attachment 1. Further details of this initial survey will be provided in the Cruise Report, which will be submitted mid-December, 1987.

**Lab Analysis: Macrofauna**

Progress on sorting and identifications of year-two samples is summarized below. Note that for operational purposes, year-two samples are defined as those samples to be included in the Year-Two Annual Report. The ability to include Priority 5 results in the Year-Two Annual Report is based on the assumption that the submission date for the Draft Year-Two Annual Report will be October 1, 1988, as recommended at the November 12-13, 1987, Annual Progress Meeting. PIs analyzing samples for meiofauna, hydrocarbons, trace metals, and sedimentology should follow this same prioritization and schedule.

| Activity | Priority Categories 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| • Sorting & QC | 100% Complete | 100% | Sorting 90% Complete; QC 75% Complete | 0% | To be collected January 1988 |
| • IDs | 95% Complete | 20% Complete | 0% | 0% | To be collected January 1988 |

Note: Priority 1 (24 samples) = Cruise CAMP 1-2 (Jan 87), 3 reps each from primary site-specific stations PJ-6, PJ-7, PJ-8, PJ-9, PJ-10, PJ-11, PJ-22, and PJ-23.

Priority 2 (30 samples) = Cruise CAMP 1-3 (May 87), 3 reps each from all regional stations R-1 through R-9 and primary site-specific station PJ-1.

Priority 3 (24 samples) = Cruise CAMP 1-3 (May 87), 3 reps each from primary site-specific stations PJ-6, PJ-7, PJ-8, PJ-9, PJ-10, PJ-11, PJ-22, and PJ-23.

Priority 4 (36 samples) = Cruise CAMP 2-3 (Oct 87), 3 reps each from regional stations R-1 through R-9, and primary site-specific stations PJ-1, PJ-10 and PJ-11.

Priority 5 (36 samples) = Cruise CAMP 2-4 (Jan 88), 3 reps each from regional stations R-1 through R-9, and primary site-specific stations PJ-1, PJ-10, and PJ-11.

Laboratory observations of processed (or partially processed) samples reveal some interesting preliminary results, as follows:

- There is a reappearance of excessive amounts of detrital material in October 1987 samples at Stations R-4 and R-5, as noted previously in samples collected last October, 1986.
- We are seeing an outbreak of juvenile Chloeia pinnata in May 1987 samples at the majority of regional and Platform Julius stations; densities of these juveniles range from about 500 to 1,200 per $0.1m^2$.
- We also are seeing increases in abundances of juvenile ophiuroids and bivalves in May 1987 samples.

Life-history analysis of year-one samples is about to begin. Candidate species are being identified and samples are being transferred from the Battelle Ventura facility to the Duxbury, MA facility for analysis. Eight macrofaunal species have been selected thus far as candidates; these species are Mediomastus ambiseta, Nephtys cornuta franciscana/N.cornuta cornuta, Prionospio lighti, Pholoe glabra, Levensenia gracilis, Spiophanes missionensis or S. berkeleyorum, Photis lacia or Rhepoxynius bicuspidatus, and Harpiniopsis epistomata. Two additional species will be selected based on results of subsequent sample analyses (especially the May 1987 samples); we have some ideas now, which might result in including some molluscs.

## Lab Analysis: Meiofauna

During October and November the following meiofaunal samples were sorted: all replicates from CAMP 1-2, Station PJ-23; and all replicates from CAMP 1-3, stations R-1 through R-9, and PJ-13. As noted in earlier monthly progress reports, preliminary identifications of harpacticoid species from a subset of CAMP 1-1 samples were being re-evaluated to clear up some taxonomic problems. This work is complete, and results show that we now have 77 species of which only nine are known to science.

## Lab Analysis: Hard-Bottom Photoanalysis

Analysis of slides from the May 1987 cruise has been initiated; these analyses are approximately 10% complete. The quality of these photographs remains high. Voucher rock specimens collected on this cruise have been sent to taxonomic specialists for identification of the component cryptic fauna.

## Lab Analysis: Hydrocarbons

Analysis of CAMP 1-3 samples (May 1987) for hydrocarbons has been completed. Data from these analyses have been reduced and submitted for entry into the CAMP computerzied data base. Samples collected on Cruise CAMP 2-3 (October 1987) were received and inventoried, and analysis of these samples is underway (samples from regional stations and PJ-1, PJ-10, PJ-11 are being analyzed; remaining site-specific samples will be archived).

## Lab Analysis: Trace Metals

Analysis of CAMP 1-3 samples (May 1987) for trace metals has been completed. Samples collected on Cruise CAMP 2-3 (October 1987) were received, and analysis of these samples should begin next month.

## Sedimentology

Analysis of CAMP 1-3 samples (May 1987) for grain size, total organic carbon, redox, and shear strength has been completed. Equipment problems associated with mineralogy analyses have been solved, and analysis of samples collected on the May cruise is in progress.

Fabrication of the new modified sediment traps is now complete. Deployment of these instruments is scheduled for the January 1988 soft-bottom cruise (as was discussed during our telephone conversation of November 24, 1987).

## Physical Oceanography

As noted in earlier monthly progress reports, current-meter data from the first two deployment periods (December 86 to February 87, and March 87 to May 87) have been collected and analyzed. Data records from the third deployment period (June 87 to October 87) are now available and are being analyzed. All current meters are now returning data through the satellite telemetry systems.

A one-day cruise on the R/V Spirit on 22 October revealed that the telemetry buoy at PJ-13A (near Platform Julius site) was slightly flooded, accounting for earlier data transmission problems. In addition to the modifications to the data-logger program mentioned in the previous monthly report, we have made other improvements to help prevent the flooding problems. These improvements include installation of temperature and humidity sensors within each telemetry buoy, which will allow transmission of temperature and humidity data via the telemtry link to warn of leaks.

## Sediment Transport and Bioturbation

See Attachment II.

## Meetings

The First Annual Progress Meeting was held in Los Angeles, at the Pacific OCS Office, on November 12 to 13, 1987. A major focus of this meeting was to discuss recommendations for revisions to the Draft Year-One Annual Report. A complete set of written comments from MMS and members of the QRB have been distributed to

each chapter author. Appropriate revisions will be incorporated into the final version of the Year-One Annual Report, which is to be submitted to MMS by January 29, 1988. In preparation for this final submission, chapter authors have been asked to submit their revised chapters to me by January 4, 1988.

A second subject of extensive discussion at the meeting was the issue of modifying the existing CAMP sampling plan to accommodate changes in proposed drilling schedules. A recommendation for a revised sampling plan was made based on consideration of (1) updated information on changes in the proposed drilling schedules for Platform Hidalgo (new spud date is late November, 1987) and Platform Julius, (new spud date is mid-October 1989 to February 1990); (2) the need to accommodate our original sampling objectives; and (3) the unexpectedly high temporal variability measured among physical, chemical, and biological parameters during our first year of predrilling sampling. Some of the important features of this revised sampling plan are as follows:

1. For soft-bottom stations, our seasonal sampling (October, January, and May of each year) shall continue through the final scheduled October 1990 cruise; however, sampling on each of these cruises will be restricted to regional stations (R-1 through R-9) and three Platform Julius site-specific stations (PJ-1, PJ-10, and PJ-11). Samples already collected during the October 1987 cruise from site-specific stations other than PJ-1, PJ-10, and PJ-11 will be archived.

2. Sediment pore-water analysis (for hydrocarbons and trace metals) at the original four Platform Julius sites (PJ-1, PJ-8, PJ-10, and PJ-11) shall be discontinued. In lieu of this work, dedicated box cores will be taken from four alternative stations along an onshore/offshore transect (R-8, PJ-1, R-9, and R-7) and subjected to a coordinated analysis of radioisotopes and other sediment properties (e.g., grain size and TOC) from subsamples collected along a series of closely spaced depth intervals within the sediment. For logistical and cost purposes, we are considering scheduling this work over a one-year period beginning October 1988 and ending May 1989. This schedule would bracket the period during which field work for the Sediment Transport Task is planned.

3. Analysis of hydrocarbons and trace metals in subsurface sediment samples (originally performed in samples from PJ-1, PJ-8, PJ-10, and PJ-11) should be coordinated with sample analyses identified in Item 2 above.

4. Certain tasks should be discontinued, and picked up possibly during the proposed Phase III Monitoring period beginning in 1991. These tasks are core radiography, pore-water analysis (as mentioned above), and collection of species at the Platform Julius sites for tissue body-burden analysis of hydrocarbons and trace metals.

5. For hard-bottom stations, the proposed May 1988 cruise shall be postponed until May 1989 to accommodate the delay in drilling at Platform Hidalgo.

6. Attempts should be made to collect additional species for body-burden analysis from Platform Hidalgo sites. Candidates are Parastichopus and Paracyathus, which could be collected with the ROV (on January and May cruises of each year). The use of baited traps at Platform Hidalgo should continue in attempts to collect the same species (Pleurobranchaea and Cancer) analyzed thus far on the program.

A revised cost proposal, reflecting these technical changes and other cost modifications, will be submitted to MMS by January 29, 1988.

A final report of QRB observations and comments resulting from the First Annual Progress Meeting is expected to be submitted within the next two weeks. A draft version of this report was provided to you at the meeting and was distributed to chapter authors to help with their chapter revisions.

**Reports**

The final version of the Year-One Annual Progress Report will be submitted to MMS by January 29, 1987. As noted in the above section, reviewer's comments on the draft report have been distributed to each chapter author, and plans have been made to incorporate the necessary revisions.

If you have questions on any of these matters, please don't hesitate to call. Happy Holidays to you and all others reviewing this monthly report.

Sincerely,

Jeffrey L. Hyland

Jeffrey L. Hyland, Ph.D.
Program Manager

cc: Ms. Frances Sullivan, MMS Contracting Officer
(MS 635, Herndon, VA)

Dr. Donald Aurand, Chief of MMS Environmental Studies Program
(MS 644, Washington, D.C.)

Attachment I

# Summary of Objectives and Preliminary Results of an Envirnomental Study Conducted in the Vicinity of the Sunken Freighter, Pac Baroness

Jeffrey L. Hyland
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December 9, 1987

## 1. Background and Purpose

On September 21, 1987, the 564-foot freighter, Pac Baroness, collided in fog with another freighter, the Atlantic Wing, approximately 20 km to the southwest of Point Conception, California. As a result of the collision, the Pac Baroness eventually sank in about 450 to 500 m of water, at a reported location of approximately 34°21.13'N latitude and 120°38.14'W longitude. This site is in the general vicinity of stations sampled during the previous Minerals Management Service (MMS) Phase I Reconnaissance Survey and just to the south of stations that currently are being monitored as part of MMS's ongoing California OCS Phase II Monitoring Program (see Figure 1).

The Pac Baroness was carrying a cargo of 21,000 metric tons of finely powdered (< 200 microns) and concentrated copper ore consisting of refined chalcopyrite, covellite, and native copper, and containing approximately 30% each of copper, sulfur, and iron. The vessel also was carrying approximately 7,500 barrels of intermediate-grade fuel oil and 280 barrels of marine diesel.

The sinking resulted in an initial spill of an estimated 20,000 gal of oil, which created a visible surface slick that could be tracked by aerial overflights for several days. Colored plumes observed at the time of the sinking also suggested that some of the copper ore may have escaped from ruptured bulkheads and hatches in the cargo holds.

The copper ore onboard the Pac Baroness consists principally of relatively insoluble copper sulfide; however, it is possible that dispersion of the material throughout oxygenated surface waters could promote oxidation of the sulfide, leading to increased concentrations of dissolved copper. Both copper (in the oxidized, soluble form) and petroleum hydrocarbons are toxic to marine organisms, even at dilute concentrations.

Battelle Ocean Sciences, through a joint research arrangement with the University of California at Santa Barbara (UCSB), is conducting a limited environmental study in the vicinity of the wreck, to locate the vessel, determine the extent of initial contamination (with a focus on copper and petroleum hydrocarbons) and examine the potential impact on benthic communities of the immediate surrounding area. Battelle also will be using results of this study to evaluate whether potential impacts linked to the sinking of the Pac Baroness will interfere with efforts to detect drilling-related impacts at nearby stations within the Santa Maria Basin, which are being monitored as part of the ongoing MMS California OCS Phase II Monitoring Program. Funding for this

study is being provided by the Minerals Management Service, the National Science Foundation, the National Oceanic and Atmospheric Administration, and the Environmental Protection Agency.

## 2. Preliminary Observations and Results from the Initial Environmental Survey

An initial environmental survey was conducted in the vicinity of the wreck, from November 17 to 20, 1987, on board the M/V Aloha (owned and operated by International Underwater Contractors, Inc.). Mobilization and demobilization occurred at Ventura Harbor, California, on November 16 and 21, respectively. The cruise consisted of two legs, separated by an at-sea crew exchange occurring approximately at midnight on November 18.

Objectives of Leg 1 were to (1) locate the sunken vessel; (2) examine the vessel with a remotely operated vehicle (ROV), and determine its condition with respect to overall damage to the hull and sources for potential discharges of oil or copper ore; (3) use the ROV with still-camera and video systems to photograph sediments and biota and to collect water samples (and possibly biological specimens and sediments) in the immediate vicinity (within 200 m) of the sunken vessel; and (4) collect live animal specimens for analysis of trace metals in tissues.

Objectives of Leg 2 were to (1) collect bottom-sediment samples (with a 0.25-$m^2$ box corer) at an array of stations near the wreck, and at comparable control stations along the same isobath, to provide a means for examining the extent of initial contamination in reference to trace metals (especially copper) and petroleum hydrocarbons, and the potential biological impact on macroinfaunal communities; and (2) obtain hydrocasts at a limited number of stations (from a subset of the sediment stations) to collect water samples for analysis of trace metals (especially copper).

Leg 1 was successful with respect to two of the primary objectives. First, the sunken vessel was located through use of side-scan sonar and the ship's fathometer. Coordinates of the vessel are 34°21.43'N latitude and 120°38.29'W longitude. The ship appears to be lying keel-side down in about 432 m of water, and oriented in a north-south direction with the bow pointed to the NNE.

Secondly, side-scan sonar records were successful in revealing that the ship apparently is twisted and fractured into at least three pieces. These same images show a zone of scattered debri within a radius of approximately 150 m of the vessel, and a slightly larger zone of disturbed sediment extending out to a radius of approximately 200 m. Based on these images, it is apparent that cargo and fuel compartments are likely to have been breached, providing a source of escape for the oil and copper ore. Additional attempts were made to inspect the vessel with the ROV; however, equipment failures precluded completion of this work. Therefore, information on the condition of the sunken vessel is limited at this time to results of the side-scan survey.

The ROV was successful in obtaining some environmental samples during the various dive attempts made on Leg 1. Some video footage of ambient sediments and biota was obtained within about 500 to 250 m to the NW of the vessel. A total of 16 water samples also was collected from three to four different localities within 300 m of the wreck via bottles attached to the ROV.

In addition to the video footage and water samples obtained with the ROV, a small grab sample of sediment was collected within a 150-m range of the vessel. No tissue samples (for analysis of trace metals or hydrocarbons) were collected on Leg 1 (although as noted below, these samples were obtained on the subsequent leg).

On leg 2, bottom sediments were collected successfully with a 0.25-m box corer (partitioned into 25 individual 0.01-$m^2$ subcores) at an array of eight stations (represented by one sample per each station) within a 500-m radius of the vessel and at a control station (represented by three relicate samples) located 8.25 km to the NW (near a historical sampling site). Subcores from these samples were collected for analysis of petroleum hydrocarbons and trace metals, benthic macroinfauna, sediment grain size, and total organic carbon. In addition, larger animals were collected opportunistically from remaining unused sediment subcores and contained for subsequent analysis of trace metals in tissues.

Hydrocasts also were obtained on Leg 2 at the control site and one of the nearfield sites, approximately 500 m to the east of the vessel. These water samples will be analyzed for trace metals. Samples were collected at various water depths at each of these two hydrocast stations.

The above work for Leg 2 was completed by approximately 1800 on Friday, November 20, at which time a weather front moved in, bringing unworkable conditions that were predicted to persist through at least the next day. Because of these conditions, the Aloha headed for port at that time, ending the cruise within the originally scheduled four-day period.

Some very interesting preliminary observations were noted from samples collected on Leg 2. Some of the more significant observations are as follows:

- Visible quantities of oil were found in all sediment samples collected within 500 m of the vessel; these levels were not seen in any of the replicated control samples collected 8.25 km to the NW.

- The oil seen in sediments did not resemble seep oil; rather, it looked more like the type of fuel oil that was contained on the Pac Baroness.

- The oily sediments within 500 m of the vessel tended to form into small "beads," which created relatively large volumes of material retained on the 300-micron sieves in comparison to control samples.

- Live animals were noted in all samples; however, there appeared to be a higher abundance of amphipods in control samples relative to the samples collected near the sunken vessel (amphipod crustaceans are known as being highly sensitive to oil toxicity).

These preliminary observations made at the time of sample collection must be confirmed analytically before reaching conclusions regarding fate and effects of contaminants linked to the Pac Baroness. These necessary laboratory analyses are proceeding at this time. Battelle is performing the analysis of hydrocarbons in sediments and analysis of macroinfaunal samples, as identified in the Revised Technical Proposal for the Pac Baroness Survey, submitted to MMS on November 4, 1987. Scientists at UCSB also are proceeding with the analysis

of copper and other trace metals in samples of water, sediment, and animal tissues. Preliminary results of this latter work at UCSB reveal that excessive amounts of copper ore are present in the same sediments that contained visible levels of oil (Stan Margolis, personal communication). These joint results suggest that the same process(es) are responsible for the initial mixing of both the oil and copper into the ambient sediments.

A follow-up cruise is scheduled for mid-January to complete the ROV survey of the sunken vessel and to obtain additional nearfield samples of sediment, water, and biota. Use of the research vessel and ROV for this cruise will be made available at no cost to the program as a result of a contribution from International Underwater Contractors, Inc.

ATTACHMENT II

Monthly Progress Report to:

Dr. Jeffrey L. Hyland, Project Coordinator
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SEDIMENT TRANSPORT AND BIOTURBATION (GO903-1301)
Subcontract to Woods Hole Oceanographic Institution for
MMS Contract No. 14-12-0001-30262

Principal Investigators:

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9 November 1987

PROGRESS REPORT
Research Completed in August, September and October 1987

Field Measurements:

The rescheduled recovery cruise to pick up the instruments deployed in May was conducted from 15-18 September 1987 aboard the M/V ALOHA. Excellent sea conditions allowed for the recovery of the GEOPROBE tripod and current-meter mooring at Station A. The current-meter mooring at Station C could not be located, however, despite intensive acoustic searches to the north, east and west of the mooring location. Box cores were taken at Stations R-8, R-9 and PJ-1 and processed as in the May cruise.

Data processing, preliminary analyses and writing of the Year-One Annual Report consumed much of August and all of September. In October, it was decided to delay the second mooring deployment associated with this Special Study on Sediment Transport and Bioturbation until December 1988 or January 1989. The deployment was originally planned for January-March 1988. The delay is necessary because of extensive damage to the two GEOPROBE systems during the first deplyment, because surface marker buoys may be required to mark the instrument locations so that fisherman may avoid the moorings, and because the M/V ALOHA is not capable of deploying these moorings. A suitable vessel could not be scheduled on such short notice; a vessel for the December 1988 deployment must be scheduled this fall. This delay will require that some of the expenditures originally planned for year 2 will have to be reprogrammed to year 3 of this Special Study.

An intensive search was conducted for the mooring at Station C on a cruise aboard the M/V ALOHA, 1-3 November 1987, using the acoustic release gear, 50 kHz EG&G side-scan sonar and the IUC ROV. Rough seas limited the time available for the search on the 56 hour cruise to about 18 hours. The mooring was interrogated at several locations to the south of the original mooring location, completing an acoustic search pattern covering about 10 miles around the site. Side-scan sonar, set at a range of 100 m, was run on tracks oriented northwest-southeast 150 m apart, extending about 2 miles past the mooring site in either direction (the large sea and swell required the tracks to be run northwest-southeast instead of along-isobath). A side-scan search extending 550 m to either side of the mooring location was completed. At the very end of the cruise, the seas had calmed sufficiently to conduct a brief sonar search with the ROV at the mooring site and 100 m to the north of the mooring site. The side-scan survey showed intensive trawl marks in the vicinity of the mooring. None of the search techniques showed any trace of the mooring. We assume that the mooring was dragged away by fishing activity and is lost without further hope of return.

Laboratory Studies:

Data analyses and writing of the Year-One Annual Report devoured most of August and September. Two papers, emanating from work supported by this contract, were also submitted to journals. These are: "One Turn of the Screw: A Simple Technique for Fine-Scale, Vertical Sectioning of Fresh Marine Sediment Cores" by C.M. Fuller and C.A. Butman (submitted to the

Journal of Sediment Petrology in August) and "Habitat Selection by Marine Larvae in Fluid Flow: A Worm Can and A Clam Can't" by C.A. Butman, J.P. Grassle and C.M. Webb (submitted to Nature in September). Following-up on the experimental results reported in the Annual Report, two more flow habitat-selection experiments were conducted with Capitella and a slow-flow and a still-water experiment were conducted with Mercenaria.

In the first Capitella experiment, the natural mud treatment was alternated with a treatment consisting of natural mud overlain with a layer of barite 3-mm thick, in the checkerboard array. The design was an attempt to determine if the positive settlement signal present in the mud, as demonstrated conclusively in previous experiments, could be masked by a barite veneer. The results showed decreased settlement in the "mud + barite veneer" treatments compared to the "mud only" treatment (mean number of larvae per replicate of 10.0±3.1 and 15.5±8.5, respective); however, an important observation made during the competency side experiments was that the larvae tended to "get stuck" in the very fine barite sediments, compared to the pure mud sediments, and thus, may not have been able to freely leave the barite treatments. The next logical experiment was to repeat this experimental design, only replacing the barite with a 4-5 mm layer of the glass-bead mixture (which has a grain-size distribution similar to the natural mud). This would at least test the potential for masking a settlement cue, without complications resulting from dramatic variations in grain size. Results of this experiment were exciting, indeed, with virtually no settlement in the "mud + bead veneer" treatment (0.2±0.4 larvae per replicate), compared to the "mud only" treatment (9.3±6.3 larvae per replicate). These results suggest that the "attractive factors" in the mud treatment can not diffuse through a 5-mm thick surface layer and/or that the larvae do not burrow this deep to explore the sediments over the 2-hr duration of the experiment. The results further imply that natural settlement can be significantly altered by relatively thin additions of exotic materials to a natural sediment surface.

The new Mercenaria flow experiment was conducted using the checkerboard design with the natural mud and glass bead treatments, only for the slowest flow speed possible in the Paddle-Wheel Flume. The purpose was to determine if the lack of habitat selection, and settlement in general, by Mercenaria in the three previous flow experiments may have been a function of the flow regime, since several recent studies indicate that Mercenaria larvae are easily displaced from the seafloor upon initial contact. The new still-water experiment used the same array as in the first Capitella experiment described above, in this case with the a priori prediction of enhanced Mercenaria settlement in the "mud + barite veneer" treatment, due to the masking of the negative organic cue (i.e., remembering that Mercenaria larvae prefer low organic sediments over organic-enriched sediments). These experiments are currently being processed.

Final plans are currently being made for joint research with Dr. Steve Stancyk (Univ. So. Carolina at Columbia) to study bioturbation and larval settlement of the burrowing, amphiurid ophiuroid, Microphiopholis gracillima, which has a life habit similar to the ophiuroids common in the Santa Barbara basin. Dr. Christine Webb will be visiting Dr. Stancyk's lab for 2-3 wks in early 1988 to carry-out some bioturbation experiments and

then will transport the reproductive adults to Woods Hole for laboratory-induced spawning and subsequent larval-rearing and -settlement studies.

RAPHY

| | NUMBER | i | l | FORMAT |
|---|---|---|---|---|
| ...us temperature | | | | |
| ...s salinity recording | | | | |
| H03 ...temperature ...nents | | | | |
| H04 ... salinity measu...nents | | | | |
| **NEAR SEA FLOOR (≤ 10 m)** | | | | |
| H05 Continuous temperature recording | | | | |
| H06 Continuous salinity recording | | | | |
| H07 Discrete temperature measurements | 13 | D 1 | A 2 | 9 |
| H08 Discrete salinity measurements | 13 | D 1 | A 2 | 9 |
| **HP PHYSICAL** | | | | |
| H09 Classical oceanographic stations | | | | |
| H10 Vertical profiles (STD/CTD) | 4 | D 1 | A 2 | 7 |
| H11 Sub–surface measurements underway | | | | |
| H12 Mechanical bathythermograph (No. of drops) | | | | |
| H13 Bathythermograph–expendable (No. of drops) | | | | |
| H14 Sound velocity stations | | | | |
| H15 Acoustic stations | | | | |
| H16 Transparency | | | | |
| H17 Optics | | | | |
| H18 Diffusion (Dynamic) | | | | |
| H80 Other measurements | | | | |
| | | | | |
| | | | | |
| | | | | |
| **HC CHEMICAL** | | | | |
| H21 Oxygen | 13 | D 1 | A 2 | 9 |
| H22 Phosphates | | | | |
| H23 Total–P | | | | |
| H24 Nitrates | | | | |
| H25 Nitrites | | | | |

| HC CHEMICAL | NUMBER | i | l | FORMAT |
|---|---|---|---|---|
| H26 Silicates | | | | |
| H27 Alkalinity | | | | |
| H28 pH | | | | |
| H29 Chlorinity | | | | |
| H30 Trace elements | | | | |
| H31 Radioactivity | | | | |
| H32 Isotopes Pb/Th in sediment | 5 | C 1 | A 2 | 9 |
| H33 Dissolved gases | | | | |
| H90 Other measurements | | | | |
| | | | | |
| | | | | |
| **P – POLLUTION** | | | | |
| P01 Suspended solids | | | | |
| P02 Heavy metals in sediment | 37 | C 1 | A 2 | 9 |
| P03 Petroleum residues | 37 | B 1 | A 2 | 9 |
| P04 Chlorinated hydrocarbons | | | | |
| P05 Other dissolved substances | | | | |
| P06 Thermal pollution | | | | |
| P07 Waste water: BOD | | | | |
| P08 Waste water: Nitrates | | | | |
| P09 Waste water: Microbiology | | | | |
| P10 Waste water: Other | | | | |
| P11 Discolored water | | | | |
| P12 Bottom deposits | | | | |
| P13 Contaminated organisms | | | | |
| P90 Other measurements | | | | |
| Heavy metals in pore water | 4 | C 1 | A 2 | 9 |
| Petroleum residues in pore water | 4 | B 1 | A 2 | 9 |
| Heavy metals in organisms | 4 | C 1 | A 2 | 9 |
| Petroleum residues in organisms | 6 | B 1 | A 2 | 9 |

## B – BIOLOGY

| | NUMBER | i | I | FORMAT |
|---|---|---|---|---|
| B01 Primary productivity | | | | |
| B02 Phytoplankton pigments | | | | |
| B03 Seston | | | | |
| B04 Particulate organic carbon | | | | |
| B05 Particulate organic nitrogen | | | | |
| B06 Dissolved organic matter | | | | |
| B07 Bacterial and pelagic micro–organisms | | | | |
| B08 Phytoplankton | | | | |
| B09 Zooplankton | | | | |
| B10 Neuston | | | | |
| B11 Nekton | | | | |
| B12 Invertebrate nekton | | | | |
| B13 Pelagic eggs and larvae | | | | |
| B14 Pelagic fish | | | | |
| B15 Amphibians | | | | |
| B16 Benthic bacteria and micro–organisms | | | | |
| B17 Phytobenthos | | | | |
| B18 Zoobenthos | 28 | A 1 | A 2 | 9 |
| B19 Commercial demersal fish | | | | |
| B20 Commercial benthic molluscs | | | | |
| B21 Commercial benthic crustacean | | | | |
| B22 Attached plants and algae | | | | |
| B23 Intertidal organisms | | | | |
| B24 Borers and foulers | | | | |
| B25 Birds | | | | |
| B26 Mammals and reptiles | | | | |
| B27 Deep scattering layers | | | | |
| B28 Acoustical reflections on marine organisms | | | | |
| B29 Biologic sounds | | | | |
| B30 Bioluminescence | | | | |

| | NUME | | | |
|---|---|---|---|---|
| B31 Vitamin concentrations | | | | |
| B32 Amino acid concentration | | | | |
| B33 Hydrocarbon concentrations | | | | |
| B34 Lipid concentrations | | | | |
| B35 ATP–ADP–AMP concentrations | | | | |
| B36 DNA–RNA concentrations | | | | |
| B37 Taggings | | | | |
| B80 Other measurements | | | | |
| Sediment X-Rays | 14 | E 1 | A 2 | 8 |
| **B5 TYPES OF STUDIES** | | | | |
| B51 Identification | 28 | A 1 | A 2 | 9 |
| B52 Spatial and temporal distribution | 28 | A 1 | A 2 | 9 |
| B53 Monitoring and surveillance | 28 | A 1 | A 2 | 9 |
| B54 Biomass determination | | | | |
| B55 Description of communities | 28 | A 1 | A 2 | 9 |
| B56 Food chains energy transfers | | | | |
| B57 Population and environments | 28 | A 1 | A 2 | 9 |
| B58 Population structures | 28 | A 1 | A 2 | 9 |
| B59 Taxonomy, systematics, classification | 28 | A 1 | A 2 | 9 |
| B60 Physiology | | | | |
| B61 Behaviour | | | | |
| B62 Pathology, parasitology | | | | |
| B63 Toxicology | | | | |
| B64 Gear research | | | | |
| B65 Exploratory fishing | | | | |
| B66 Commercial fishing | | | | |
| B67 Aquaculture | | | | |
| B90 Other measurements | | | | |
| | | | | |
| | | | | |



☆ U.S. Government Printing Office: 1979—668–080