Utilization 92-04

CRUISE REPORT

Ship Utilization Data

UNOLS 12/89

1. Ship Name	2. Operating Institution	3. Cruise (leg) Number
R/V MAURICE EWING	Lamont-Doherty Earth Observatory Palisades, N.Y. 10964	EW 92-04

4. Dates of Project:
Begin: 28-Apr-92
End: 11-May-92

Port Calls

Place	Date
Papeete, Tahiti	28-Apr-92
Nuku Hiva, Marquesas, Islands	11-May-92

5. Number, Sea Days	6. Number, Port Days
12	2

8a. Area of Operations, Area Index and Geographic Description

88 SP SP5 Marquesas Fracture Zone

8b. Research in Foreign Waters?_Y___

Country: French Polynesia

7. Participating Personnel:

Code Title,Name,Institution	Function on Cruise (Ch.Sci.,Obs.,Tech.,Grad. Student, Undergrad, For.Obsv.)	Dates (If less than entire cruise)
1. Dr. Marcia McNutt, MIT, Chief Scientist		
2. Dr. David Caress, L-DEO, Scientist		
3. Dr. Robert Detrick,WHOI, Scientist		
4. Jeff Babcock, Scripps IO, Student		
5. Martha Kuykendall, Eckerd Colleg, Student		
6. Maya Tolstoy, Scripps I O, Student		
7. Michael Rawson, L-DEO,Technician		
8. Jim Dolan, WHOI, Technician		
9. Dave Willoughby, Technician, SIO		
10. Crispin Hollingshead, SIO, Technician		
11. Paul Zimmer, SIO, Technician		
12. Joe Stennett, L-DEO, Sciuence Officer		
13. John DiBernardo, L-DEO, Air Guns technician		
14. Ropate Maiwiriwiri, Core Bosun, L-DEO		
15. Carlos Alvarez, L-DEO, Air Guns Technician		
16. Staphanus Budhypromano, Computer Technician, L-DEO		
17. Carlos Gutierrez, Techncian, L-DEO		

Use reverse of necessary

9. Primary Project(s)

a. Project Title,Principal Investigator,Institution | b.Sponsoring Agency/ | c.Grant or Contract | d.Participating Personnel | ee. Discipline

a. "An Ocean Bottom Seismometer Experiment to Determine the Velocity Structure of the Marquesas Islands", Marcia McNutt, MIT
b. NSF c. OCE 88-17804 d. Code 1-3,8,5 e.GG

10. Ancillary Project(s)

a. Project Title,Principal Investigator,Institution | b.Sponsoring Agency/ | c.Grant or Contract | d.Participating Personnel | ee. Discipline

The OBS deployments were subcontracted to Scripps Institute of Oceanography

11. Science Party:

Scientists__3__ Grad. Students_2___

Undergrads__1__ Techncians __11__

Observers_____

Foreign Observers_____

12. Cost Allocation Data

a. Days Charged	b. Agency or Activity Charged	c. Grant or Contract No.
14 Days	NSF	OCE90-01169

13

Michael Rawson, Marine Science Coordinator
Title, Signature, Operating Institution Official

Date Jan 26, 1993

1/27/93

To: Aitken, T. L-DGO
Chayes, D. L-DGO
Cox, L. L-DGO
Eaton, G. L-DGO
Hayes, D. L-DGO
Weissel. J. L-DGO
MARSCICO, L-DGO
Science Officer EWING
Captain EWING
File Copy L-DGO

RESEARCH CRUISE REPORT

R/V MAURICE EWING, LEG 92-04

"An Ocean Bottom Seismometer Experiment ot Determine the Velocity Structure of the Marquesas Islands

P.I. Marcia Mcnutt
Dates: April 29, 1992 through May 10, 1992
Ports: Papeete, Tahiti and Taiohae, Huku Hiva

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Cambridge, Massachusetts 02139-4307

DEPARTMENT OF EARTH, ATMOSPHERIC, AND PLANETARY SCIENCES

20 May, 1992

Preliminary Cruise Report

Ship Name: R/V *Maurice Ewing*

Operating Institution: Lamont-Doherty Geological Observatory of Columbia University, New York

Dates: April 29, 1992 through May 10, 1992

Project Title: An Ocean Bottom Seismometer Experiment to Determine the Velocity Structure of the Marquesas Islands

Chief Scientist: Marcia McNutt (MIT)

Clearance Countries: Governments of French Polynesia and France

Foreign Participant: none available

Port Calls: Papeété, Tahiti and Taiohae, Nuku Hiva

Description of Scientific Program:

We deployed 6 ocean bottom seismometers (OBSs) along a 100-km line across the Marquesas Islands between Nuku Hiva and Hiva Oa. These OBSs recorded seismograms for 3 refraction profiles shot along and across the array using the ship's airgun array as the sound source. The data will be used to infer the deep seismic velocity structure beneath the Marquesas Island chain. Further details are contained in the attached cruise report.

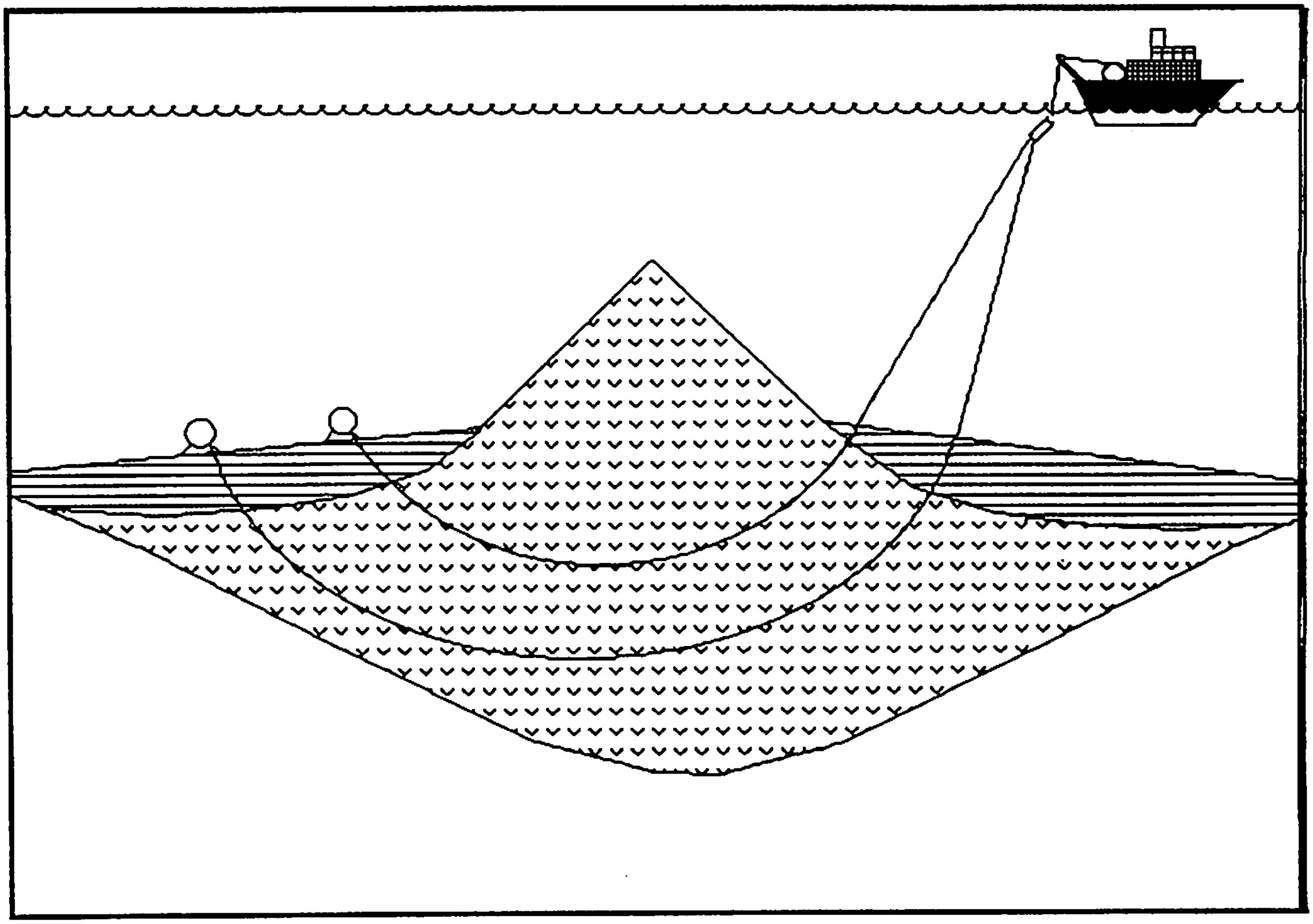
Data Observations and Samples Collected:

In addition to the seismograms recorded by the OBSs, we also collected limited underway geophysical data (bathymetry, gravity, and magnetic field) during transits to and from the survey area. Plots of the underway data are appended to this report. A magnetic tape of the geophysical data can be obtained upon request from Lamont-Doherty.

No samples were taken.

The data will be stored in Lamont-Doherty's underway geophysical data center.

Reprints of published results will be supplied as they are published within the next three years.



EW9204
CRUISE REPORT

"AN OCEAN BOTTOM SEISMOMETER EXPERIMENT TO DETERMINE THE VELOCITY STRUCTURE OF THE MARQUESAS ISLANDS"

Marcia McNutt
Massachusetts Institute of Technology
Chief Scientist

R/V *Maurice Ewing*
Papeété, Tahiti to Nuku Hiva, Marquesas Islands
29 April - 10 May, 1992

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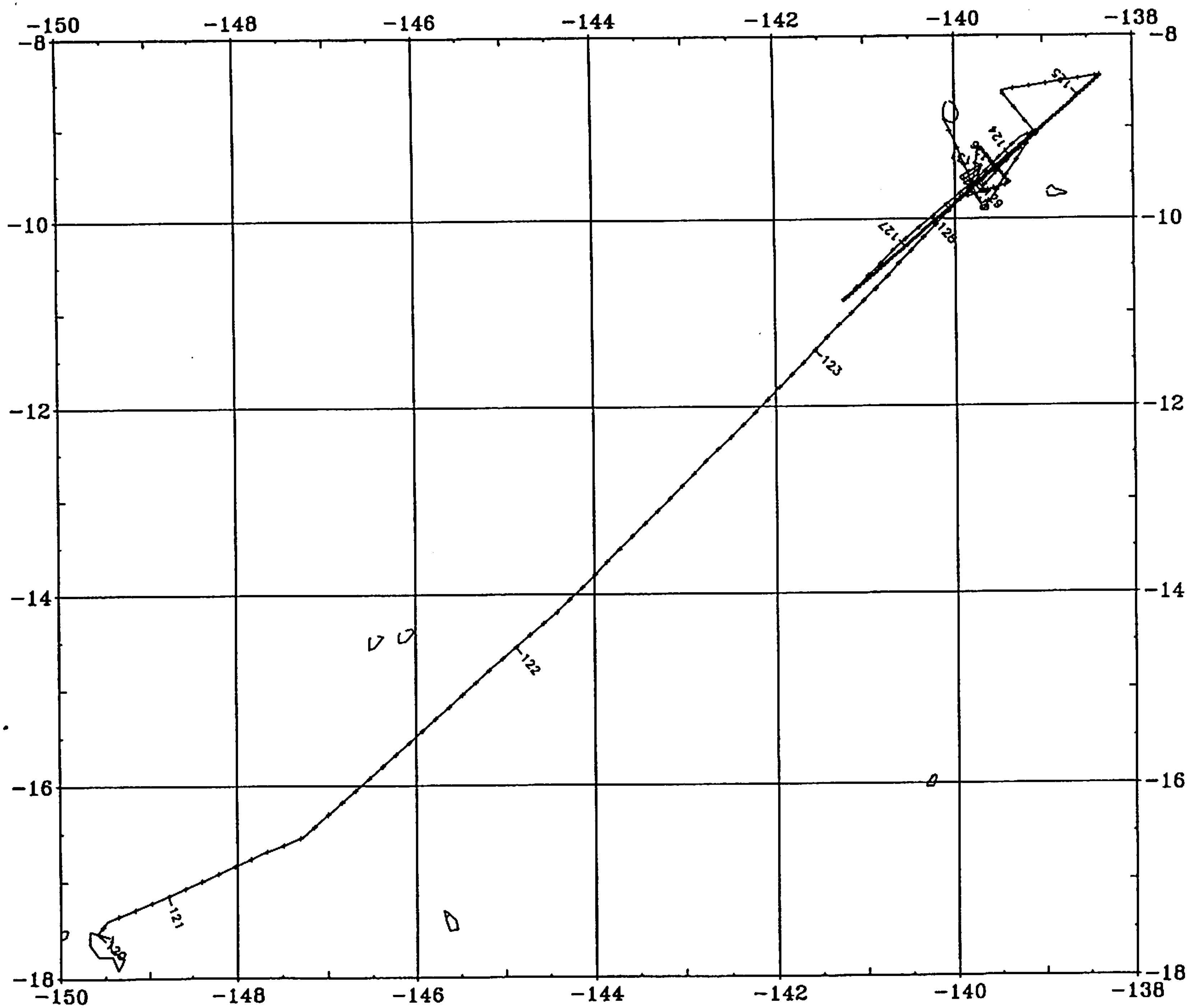


EW-9204 PAPEETE, TAHITI - NUKU HIVA NAVIGATION TRACK JDAY 120-131 ; SCALE = .66 inch/deg.

BACKGROUND

The principal goal of this expedition was to acquire seismic velocity information for the crust and upper mantle beneath the Marquesas Islands. This information will be used to infer the composition of the crust beneath the sea floor and to convert the multichannel seismic lines for the Marquesas area shot during EW9103 from time sections to depth sections.

During the cruise EW9103 (May-June, 1991) on the R/V *Maurice Ewing*, we conducted a multichannel seismic reflection (MCS), seismic refraction, and gravity survey of the Marquesas, Society, and Tuamotu island chains in French Polynesia. The primary purpose of this experiment was to probe the structure of the volcanic edifices, the surrounding moats, and the flexed oceanic lithosphere beneath the three hot-spot chains. Originally, this expedition was to be a two-ship seismic experiment involving the *Ewing* and the French seismic vessel, the *Noroit*. The *Noroit* was to be equipped with a 48-channel analogue streamer for acquiring wide-angle reflections and expanding spread profile (ESP) data with the *Ewing*'s airguns as the sound source. The wide-angle reflections would permit continuous profiling of the Moho while the ESP data would provide detailed velocity information throughout the crust at selected points within the island chain and its flexural moat. Unfortunately, the French withdrew their participation in the experiment approximately month before the start date of EW9103. It was not possible to find a substitute seismic vessel on such short notice.

Ocean bottom seismometers (OBSs) were a reasonable alternative for getting large source-receiver offsets without requiring another ship, but could not be transferred to the *Ewing* in time for EW9103. We attempted to ship the OBS equipment to Valpariso in July, 1991 so that it would be available for use on EW9106, a survey of the Marquesas Fracture Zone that would be carrying our operations close to where the seismic velocity information was required. However, the OBS van failed to arrive in Valpariso on schedule, and to further delay the sailing of the ship would cut so many science days from EW9106 that it would not be possible to perform the seismic experiment within the remaining ship time. Finally, in late April, 1992, we succeeded in getting both the *Ewing* and the OBS equipment back to the Marquesas Islands as a brief stop in a long transit for the ship from the Woodlark Basin to the Caribbean.

Of particular interest is MCS line 1162 shot from the NE to the SW across the center of the Marquesas Island chain. The line was located in a gap between the islands where the topography is largely subdued , except for a volcanic edifice at the SW edge of the platform. The stack of line 1162 clearly images the thickening of the archipelagic apron as the islands are approached and the burial of the pre-existing crust under more than 4 km of volcanic and volcaniclastic material between the islands. A weak Moho reflection is observed away from the islands, suggesting that the Moho transition is more gradual in this region than observed elsewhere in the Pacific (e.g., near the EPR). Near and in the islands the Moho reflection is not imaged as a result of seafloor multiple interference (the 5th multiple rises through the expected location of Moho as the bathymetry shoals towards the islands) and the increased crustal thickness. Analysis of gravity collected along line 1162 suggests that the base of the crust may be depressed as much as 5 to 6 km.

A series of sonobuoy seismic refraction experiments was conducted along line 1162; 14 sonobuoys were deployed at roughly 25-km intervals along the NE side of the islands through the center of the islands (Figure A). The sonobuoy experiments were extremely successful (Figure B), allowing the crustal structure and thickness to be determined through thhe flexural moat NE of the islands. Away from the islands, the velocity structure is "normal" for oceanic crust; as the islands are neared the pre-existing crust is increasingly buried under the archipelagic apron. The sonobuoys within the islands constrained the crustal structure to depths of 4 to 5 km, but the markedly increased crustal thickness within the island chain made it possible to constrain the deep crustal structure. Since the MCS data were unable to image Moho in the islands, we currently have no seismic constraints on the deep structure beneath the Marquesas Islands.

It is possible that in addition to the surface loading of the plate by extrusive volcanics, there has been some underplating of the pre-existing crust by gabbroic intrusions; in this model we would expect a high velocity (approximately 7.3 km/sec) root extending into the mantle (approximately 8 km/sec) under the lower crustal velocities (6 to 6.5 km/sec). The crust might also be thickened by intrusion within the pre-existing crust, presumably producing a much thicker section with normal crustal velocities.

EXPERIMENTAL PLAN

We conducted during this expedition a seismic refraction tomography experiment to image the deep velocity structure under the island platform. We deployed 6 Scripps Ocean Bottom Seismometers (OBSs) and an array of 20 airguns firing 8400 in^3 of 2000 psi compressed air. The principle refraction line for the OBS experiment was coincident with line 1162 and the most of the EW9103 sonobuoys. Additional sonobuoys were shot to the SW of the islands to duplicate the coverage already obtained to the NE. One sonobuoy was also shot at the location of sonobuoy 19 from EW9103, which failed. Another short refraction line was place perpendicular to the main line in the sedimentary basin between Nuku Hiva and Hiva Oa. All of the seismic reflection and refraction data will be analyzed together to constrain the structure across the Marquesas Islands.

Thanks to the unexpected success of the sonobuoy refraction lines, the region along line 1162 for which we currently have no constraints on deep structure is only about 200 km long, centered on the island platform. We needed to deploy the instruments so that crossing raypaths are obtained at lower-crustal depths. The most important phase is the PmP reflection off the base of the crust, which will likely be strongest at ranges of 40-50 km in the thickened crust of the platform. In order for PmP raypaths to cross at depth, the instrument spacing should be half or less than the PmP ranges, that is, 20 to 25 km or less. Unfortunately, with only one deployment of 6 instruments available to us, we would be unable to obtain dense sampling of the entire platform.

To spread the instruments over the entire 200 km line, we would have had to use an instrument spacing of 40 km.

Our preferred plan was to deploy the instruments with a 20 km spacing in the center of the island platform. This allows us to constrain the deep structure in the center of the islands where the crust is likely to be thickest and any high-velocity crustal root is likely to be concentrated. In addition, compared to the alternative of deploying the instruments evenly spaced over the entire 200-km gap, this plan involved less steaming distance for the ship, permitting time for one or more lines crossing perpendicular to the line of the OBSs. Raypaths associated with this deployment pattern and a reasonable but hypothetical velocity model are shown in Figure C. This deployment pattern does limit our ability to resolve structure along the sides of the platform, but will resolve properly the structure of most interest. This plan also minimized the damage if one of the OBSs failed because the resulting gap would only be 40-km wide.

In order to minimize water wave interference, avoid seafloor multiple interference, and reduce the ambient noise levels, we needed to make the time intervals between shots as large as possible. However, for processing considerations, a shot spacing of 25 to 50 meters is desirable, in order to allow trace stacking and f-k filtering. The slowest that the airguns could be towed was 3 kts, or 5.6 km/hr. Even at that speed, the guns were hanging so close to the transom that the entire ship shook with each shot. We adopted a 40-sec shot interval because the airguns should not be shot more frequently than every 40 sec.without bringing another compressor on line. The shot spacing was therefore approximately 60 m. During the very first part of the first refraction line, we shot every 60 sec (shot spacing of 90 m) since we were at long range from our receivers. For the second refraction line (perpendicular to the main line), we towed the guns at 4 kts (shot spacing every 80 m). The final line, a repeat of the central part of the first line in order to fill in data gaps while the OBSs dumped their buffers, was shot at 5 kts (shot spacing 100 m) since we were running out of time.

OPERATIONS

Friday, 24 April, 1992. Ship arrived in port in Papeete at 0800L to end EW9203. OBS van loaded onto ship by 0930L and ship moved to fueling dock. Refueling completed in a few hours.

Saturday, 25 April, 1992. Offloaded the streamer from the reel, shipping most of the sections and all damaged ones to Digicon in Singapore. Thirteen sections were left on the reel for Shipley's cruise in June, and 6 additional sections were left on the two small reels for spares.

Sunday-Tuesday, 26-28 April, 1992. Exchanged members of crew and scientific party. All scientific shipments arrived except for explosive bolts for the OBSs, which we held up in LAX on account of safety issues for airfreighting class C explosives. No chance of receiving them before sailing, but decided that we had enough already on board.

Wednesday, 29 April, 1992. Ship sailed at 0900L. Maggie deployed at 1200L and began official undeerway watches. Depth from Hydrosweep center beam, maggie, and KSS-30 gravity being logged. During transit to Marquesas area, chose route through Tuamotus passing between Kaukura and Toau, east of Rangiaroa passage, in order to get a different bathymetry/gravity crossing of the plateau compared to what was sampled in Ew9103 and EW9106. Conducted first fire and boat drill and 1520L. Caress, Willoughby, Detrick, and McNutt worked out the following schedule for the OBS operations based on an ETA at the first drop site of 0200L on 5/2/92:

Local	GMT	Activity
0900 4/29/92	1900 4/29/92	leave port, steam towards survey area
0200 5/2/92	1200 5/2/92	arrive at first deployment site
0200 5/3/92	1200 5/3/92	complete deployment, steam to NE end of line
1000 5/3/92	2000 5/3/92	begin 1st refraction run
0800 5/6/92	1800 5/6/92	end 1st refraction run, recover guns for maintenance and steam to start 2nd line
1700 5/6/92	0300 5/7/92	begin 2nd refraction run in center of OBSs
0500 5/8/92	1500 5/8/92	end 2nd refraction run, begin recovery of OBSs
0500 5/9/92	1500 5/9/92	end recovery of OBSs, begin additional sonobuoy work
1000 5/10/92	2000 5/10/92	arrive Nuku Hiva

This schedule then led to the following OBS program:

OBS	Name	Deploy Site	Start Schedule 1	Start Calibrate	Start Schedule 2	Time Release
1	Janice	9°41.4'S 139°49.8'W	1600Z 5/3	2000Z 5/6	2100Z 5/6	1600Z 5/9
2	Judy	9°33.3'S 139°40.2'W	1610Z 5/3	2010Z 5/6	2110Z 5/6	1900Z 5/9
3	Sharyn	9°26.1'S 139°31.9'W	1620Z 5/3	2020Z 5/6	2120Z 5/6	2200Z 5/9
4	Karen	9°19.4'S 139°23.4'W	1630Z 5/3	2030Z 5/6	2130Z 5/6	0100Z 5/10

5	Opus	9°12.1'S 139°14.9'W	1640Z 5/3	2040Z 5/6	2140Z 5/6	0400Z 5/10
6	Phred	9°4.0'S 139°5.4'W	1650Z 5/3	2050Z 5/6	2150Z 5/6	0700Z 5/10

Thursday, 30 April, 1992. Passed by Tuamotu atolls in early hours of the morning. Continued to steam towards first drop site.

Friday, 1 May, 1992. Continued to steam towards Marquesas Islands. Crossed onto the archipelagic apron at approximately 1700L.

Saturday, 2 May, 1992. Pulled in magnetometer about 0230L and arrived at first deployment site at 0300L. Procedure for launching OBSs was to use the small crane in the OBS van to place the OBS on the A deck just aft of the van. The OBS was then attached with a 30' line to the ball and hook of the port crane, picked up off the deck with the crane arm fully extended upward, and lifted over the side while steadied by two tag lines. The OBS was lowered into the water far out from the ship so that the tag lines could be slipped early without fear of hitting the ship if the OBS started to swing. The OBS was lowered 30' for final checkout, and then the crane arm was swung alongside the waist deck. The rope securing it to the crane was then cut, allowing the OBS to sink.

Launched first OBS (Janice) at 0328L. Position of ship at launch time: 9°41.3928, 139°49.8727. Some problems with the OBS just prior to launch. Gave false signal to release while in van, but before bolts inserted. Decided to forego diagnostics while in the water but near surface to avoid a false release. OBS reached bottom safely. Performed a limited ranging perpendicular to the line. OBS #2 (Judy) released at 0743L at 9°33.4192S, 139°40.3721W. OBS #3 (Sharon) released at 1035L at 9°26.0855S, 139°31.9261W. OBS #4 (Karen) released at 1330L at 9°18.599S, 139°23.551W. OBS #5 (Opus) released at 1630L at 9°12.055S, 139°14.918W. OBS #4 (Phred) released at 1931L at 9°03.9753S, 139°05.3999W. After completing a small ranging survey for Phred, we conducted a brief run up along the eastern flank of the Marquesan moat to consume some time so as not to deploy the airguns at the start of the refraction line before the seismometers open their first recording window.

Sunday, 3 May, 1992. Began deploying airguns at 0600L. Guns fully deployed by 0715, but problems with self-firing with a few of the guns, and some gun tangles on account of the slow towing speed (3 kts). By about 1000L, all guns problems were cleared up. First part of line shot with 60 sec pop rate. At 2000L, changed firing rate to 40 sec to get denser shot spacing near center of the array. Launched first sonobuoy (#32, so that numbers will be consecutive with those of EW9103) at 2006L at the location of sonobuoy 19, which failed during EW9103, leaving a gap in the crustal velocity data.

Monday, 4 May, 1992. Continued shooting refraction Line 1. In evening, began shooting more sonobuoys to get a sequence across the western flexural moat to compare with those shot on EW9103.

Tuesday, 5 May, 1992. Continued shooting refraction Line 1 to OBSs and sonobuoys.

Wednesday, 6 May, 1992. Finished last sonobuoy about 0615L and recovered airguns to end refraction Line 1. Steamed at full speed to the northeast to run refraction Line 2 in the sedimentary basin south of Nuku Hiva at right angles to Line 1 and across OBS #3, Sharon. Began deploying airguns at approximately 1930L to run Line 2.

Thursday, 7 May, 1992. Completed refraction Line 2 at 0330L. Arrived in position to start Line 3 at about 1100L. Ranged to OBSs as we passed over them to make sure that they were still in position, but didn't hear from all of them.

Friday, 8 May, 1992. Recovered airguns for last time at 0130L and began OBS recovery at 0300L. The first two attempts at recovery failed. We could not even hear the first OBS, Phred, on the hull transducer, so moved on to Opus. We could hear Opus, but would not respond to acoustic release command. Moved on to Karen. In the meantime, found several problems which were impacting the ability to communicate with the OBSs. The most severe was a poor gounding of the connection between the OBS van and the ship's transducer, resulting in low power output and several blown power transducers in the acoustic control unit. Fixed the problem, and recovery of Karen, Sharyn, Judy, and Janice went smoothly. Retuned to other end of line and successfully released and recovered Opus. All recoveries were done off the starboard side. The Captain brought the ship alongside the OBS such that the OBS was in the lee of the ship. Long poles with hooks and tag lines were used to snag the OBSs from the waist deck. The OBS was then hooked to a line fed through the starboard A-frame, a block on the deck, and then to a capstain on the fantail. After lifting the OBS onto the deck using the cxapstain and A-frame, it was rolled around to the port side of the fantail on a small dolly with wheels. From there, it was lifted to the back doors of the OBS van using the port crane and tag lines.

Saturday, 9 May, 1992. Phred still not responding. Returned to west end of line for brief survey of Dumont Durville du Nord while we waited for the time release of Phred. Steamed back to east end of line. Still received no signal from Phred, and did not hear sound of bolts firing at 2100L when time release was to have occurred. However, Phred did appear on the surface just before 2300L. Got underway for one last pass of Dumont Durville du Sud before heading into Nuku Hiva harbor.

COMMENTS AND RECOMMENDATIONS

Although we have yet to analyze the data, the preliminary data dump performed on board by David Caress indicated that all 6 seismometers had recorded the airgun arrivals for the entire duration of the deployment. Therefore, the expedition met all of its objectives in terms of data collection. Several groups deserve the credit for the success of this project.

The Scripps Ocean Bottom Seismometer group, led by David Willoughby, was well organized and managed to prepare all 6 instruments for deployment on schedule despite a very short transit to the survey area. After recovery of the instruments, they were extremely efficient in removing the data cartridges from the instruments and repacking the van for shipping, again with only a day or two.prior to returning to the U.S. In both cases, the OBS engineers and graduate students had to forego shore leave in Tahiti and the Marquesas Islands in order to get their jobs done. Furthermore, the group worked around the clock on both deployments and recoveries to ensure the safety and proper operation of the equipment. Throughout the entire operation, they worked well with the crew and other members of the scientific party, welcoming their suggestions and help when offered.

As usual, the airgun operation ran extremely smoothly in the hands of the Lamont airgun crew, led by John Dibernardo. Airgun deployment and recovery was always accomplished in less than the time budgeted (1 hour) for these operations. No science time was lost on account of poor operation of the airgun array.

Joe Stennet, the *Ewing*'s Science Officer, put in extremely long hours during the seismic work, both in minimizing the impact of crashes of the DSS recording system and in ensuring high-quality sonobuoy reception. He clearly works very hard to fix and maintain all of the science equipment so that the capabilities of the ship can be fully utilized. Stefanus Budhypramono, the System Manager, did his usual efficient job of keeping what is becoming an increasingly large complex of various computers up and running. Despite being asked to log data up to the point when the ship dropped anchor in Nuku Hiva, he managed to have data tapes and the post-crusie data summary completed for the chief scientist before he took any shore leave.

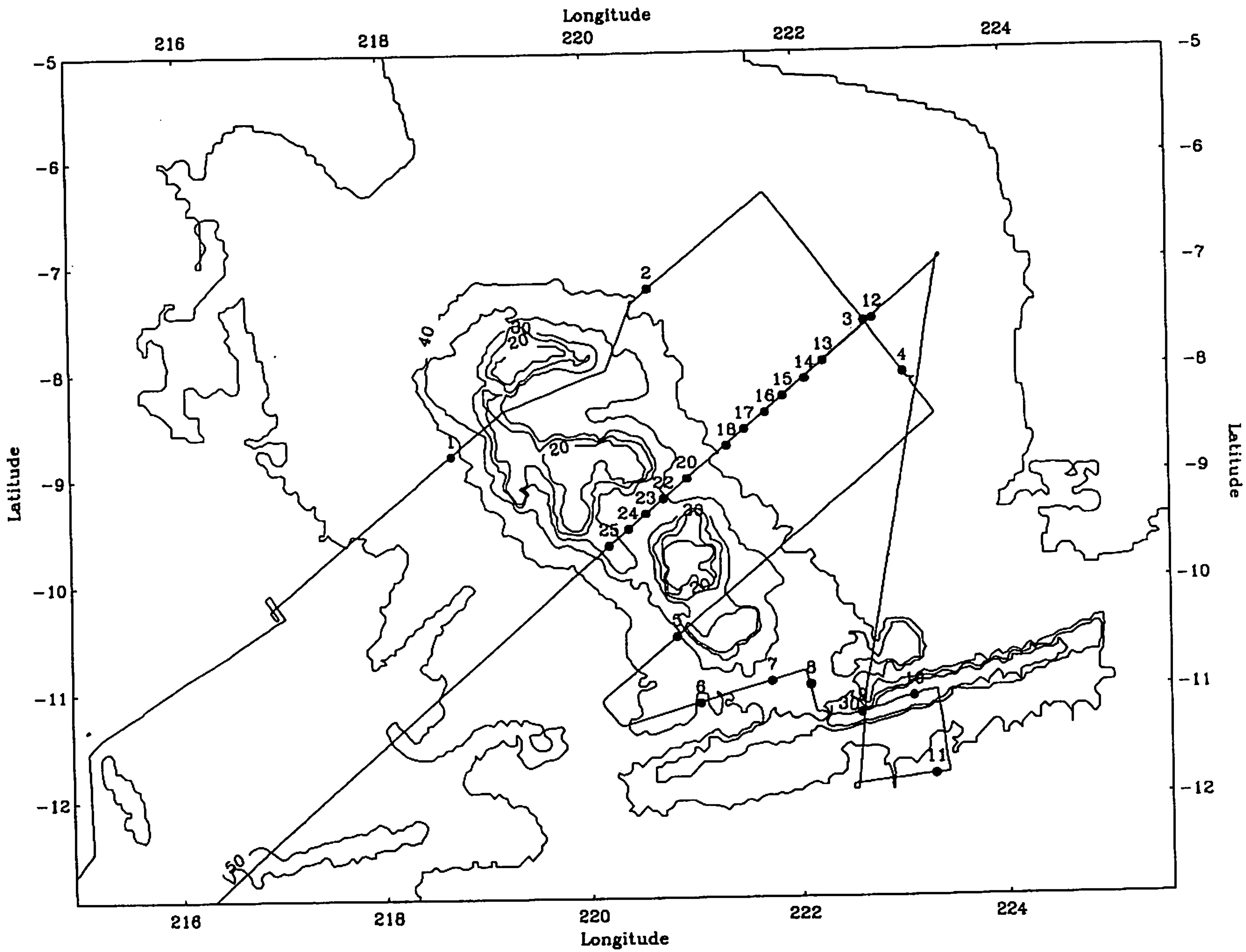
The ship's officers and crew, under the leadership of Captain Ian Young, worked extremely well with the scientists and technicians during all aspects of this expedition. The crew loaded the OBS van onto the ship within one or two hours arriving in port, thus allowing the OBS team to get to work immediately. The deployment and recovery of the OBSs was the first attempt by the *Ewing* to work with free vehicles. Thanks to the superb ship handling during these operations, the procedures went very smoothly and safely for both the personnel and equipment. Chief Mate Lou Mello and Bosun John Santini ensured that each OBS was deployed within minutes of being ready. Captain Young maneuvered the ship along side each OBS on recovery such that each was hooked on the first pass within minutes of surfacing. Throughout the expedition, the entire crew was extremely cooperative and interested in the scientific mission. We are particularly indebted to Matthew Van Dyne for agreeing to delay his vacation to stay on the ship for this expedition following the unexpected illness of the relief 3rd engineer. This sort of dedication to the vessel and its science operations seems typical of the *Ewing*'s crew.

One recurring problem we faced during this trip were repeated crashes of the DSS recording system, similar to those we experienced during EW9103. Since we were not collecting seismic reflection data from the streamer, the system crashes were less of a problem in terms of data collection than they were last year, but nevertheless we generally lost a few airgun shots because the guns were triggered off the DSS system and if a sonobuoy was in the water, we lost some data. Some of the crashes only resulted in losing a shot or two, but for some others, it took a longer time to bring the system back up. Joe Stennet worked extremely hard to identify the source of the problem, but it is not clear that it will not reoccur on future legs. We recommend that some effort be placed in either fixing or replacing some components of the recording system.

If the *Ewing* is used again for OBS work, we recommend that the van be placed on the starboard side of the ship (where the MCS van is presently) and that the starboard crane be used for deployments. We had no severe problems for this leg in using the port crane thanks to very calm seas and perfect weather. However, it was necessary to maneuver the OBS in the air around the crane cradle and several other pieces of equipment on the starboard side of the A deck without having good control of the instrument with tag lines. The recoveries using the starboard A-frame went very smoothly, but this procedure cannot be used for launching because the OBSs weigh too much with their anchors attached.

Another modification that should be considered is moving the RDF antenna to another location. Once the OBSs surfaced, we immediately received a signal on the RDF, but the direction indicated seldom bore much resemblance to the true location of the instrument relative to the ship. Fortunately, this lack of direction information caused little problem on this leg. With GPS navigation for both deployments and recoveries and apparently low current velocities at depth, we consistently found the OBSs surfacing less than a few 100 meters from the ship. Calm seas made the OBSs easy to spot even in daylight. Under less than ideal conditions in the future, a valid azimuth from the RDF might be critical during recovery. The ship's officers suspect that the present mounting of the RDF leads to too much interference from other radio signals. Remounting the antenna at another location might solve the problem.

Except for these few problems, we were pleased with all other operations of the ship and the science equipment.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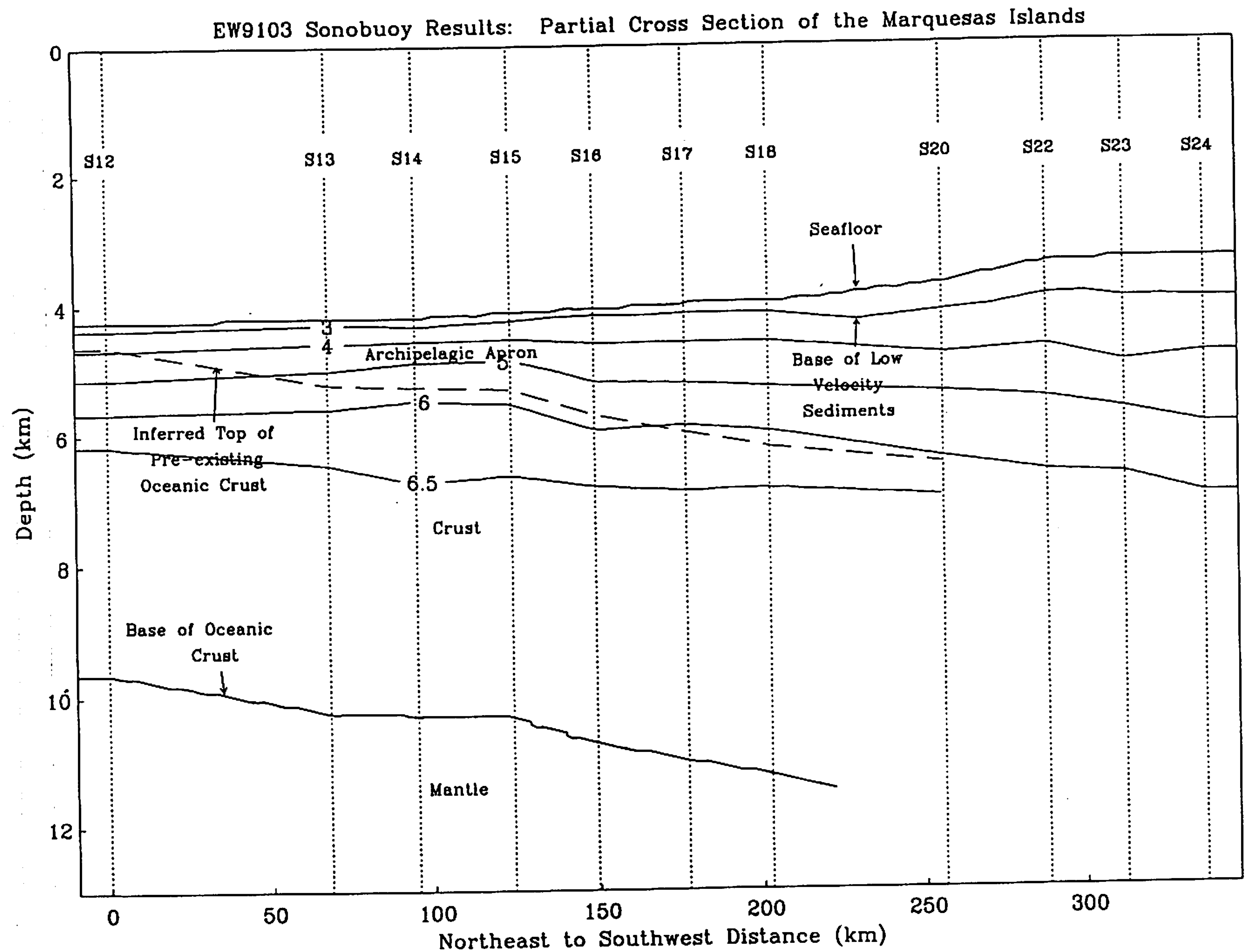
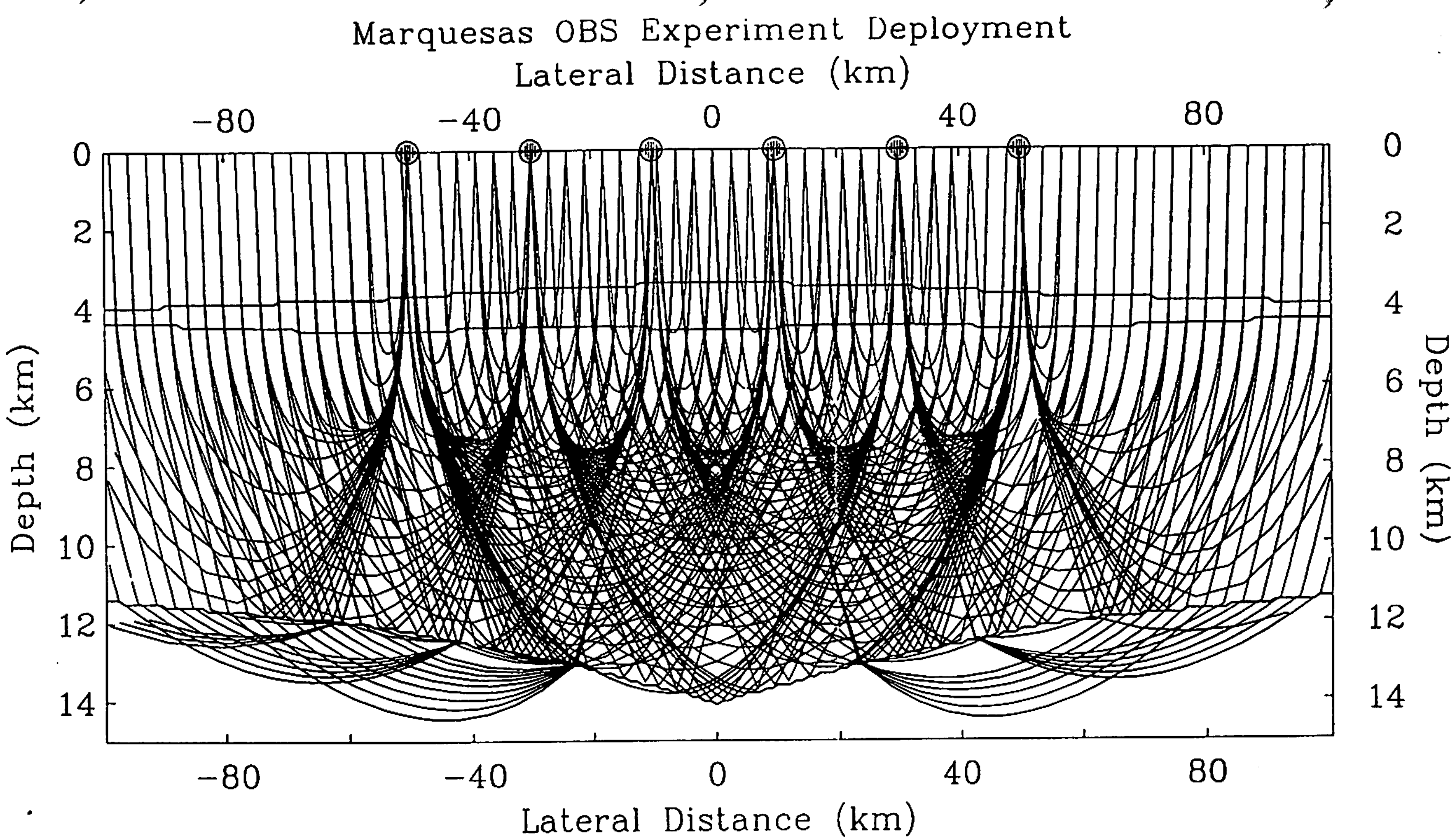

EW9103 Sonobuoy Results: Partial Cross Section of the Marquesas Islands
S12
S13
S14
S15
S16
S17
S18
S20
S22
S23
S24
Seafloor
Base of Low Velocity Sediments
Archipelagic Apron
3
4
5
6
6.5
Inferred Top of Pre-existing Oceanic Crust
Crust
Base of Oceanic Crust
Mantle
Depth (km)
Northeast to Southwest Distance (km)



20 km instrument spacing

SCIENTIFIC PARTY

Scientists
Marcia McNutt (MIT) Chief Scientist
David Caress (LDGO)
Robert Detrick (WHOI)

Students
Jeff Babcock (SIO)
Martha Kuykendall (Eckerd)
Maya Tolstoy (SIO)

Technical Support
Michael Rawson (LDGO)
Jim Dolan (WHOI)
Dave Willoughby (SIO) OBS
Crispin Hollinshead (SIO) OBS
Paul Zimmer (SIO) OBS
Joe Stennet (LDGO) Science Officer
John Dibernardo (LDGO) airguns
Ropati Maiwiriwiri (LDGO) airguns
Carlos Alvarez (LDGO) airguns
Stephanus Budhypramono (LDGO) System Manager
Carlos Gutierrez (LDGO) Electrical Technician

SB	Line		Start Date			End Date				Start	End		
#	#	Julian	Calendar	GMT	Julian	Calendar	GMT	Latitude	Longitude	Depth(m)	Depth(m)	File #	Notes
32	Marq-10	125	4 May '92	607	125	4 May '92	1200	8°52'S	138°51'W	2200	3718	?-315	data gap-system crash
33	Marq-10	126	5 May '92	357	126	5 May '92	800	9°35.4'S	139°42.8'W	2354	3450	5-1776	
34	Marq-10	126	5 May '92	515	126	5 May '92	848	9°38'S	139°46'W	1367	3580	5-1894	
35	Marq-10	126	5 May '92	928	126	5 May '92	1413	9°46.2'S	139°55.9'W	3675	4058	6-3500	
36	Marq-10	126	5 May '92	1416	126	5 May '92	1953	9°56.0'S	140°7.0'W	4057	4187	9-4188	
37	Marq-10	126	5 May '92	1955	126	5 May '92	2300	10°9.0'S	140°22.5'W	4190	4150	10-5306	
38	Marq-10	126	5 May '92	2324	127	6 May '92	431	10°17'S	140°32'W	4150	4235	11-5620	
39	Marq-10	127	6 May '92	444	127	6 May '92	1040	10°28.4'S	140°45.2'W	4236	4304	12-6187	
40	Marq-10	127	6 May '92	1054	127	6 May '92	1617	10°40.8'S	141°0.3'W	4307	4396	13-6742	
41	Line 2	128	7 May '92	553	128	7 May '92	1200	9°14'S	139°42'W	3200	3312	14-0035	
42	Line 2	128	7 May '92	2107	129	8 May '92	200	9°44.8'S	139°54.3'W	3584	3388	15-1407	reversed profile w/#34
43	Marq-10	129	8 May '92	219	129	8 May '92	518	9°28.8'S	139°34.7'W	3386	3416	15-1856	
44		128	8 May '92	633	129	8 May '92	1000	9°14.96'S	139°18.5'W	3438	3692	16-8506	