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SCRIPPS INSTITUTION OF OCEANOGRAPHY
UNIVERSITY OF CALIFORNIA, SAN DIEGO
LA JOLLA, CALIFORNIA 92093

Westward Expedition



R/V Melville
November 1993 - June 1994

LEGS 1-5

CRUISE PROSPECTUS

Robert A. Knox
Robert A. Knox
Associate Director, SIO

Westward EXPEDITION

R/V MELVILLE

Leg 01

T. Urabe, Geophysical Survey of Japan
81-298-54-3636
OBS, SEA BEAM, CTD
San Diego - Papeete
23 Nov - 30 Dec 1993

Leg 02

P. Lonsdale, Scripps Institution of Oceanography
(619) 534-2855
SEA BEAM
Papeete - Wellington
3 Jan - 8 Feb 1994

Leg 03

S. Bloomer, Boston University
(617) 353-5511
J. Natland, RSMAS
(305) 361-4123
P. Castillo, Scripps Institution of Oceanography
(619) 534-0383
Dredging, SEA BEAM
Wellington - Iquique
14 Feb - 21 Mar 1994

Leg 04

M. McCartney, Woods Hole Oceanographic Institution
(508) 548-1400 X2797
WOCE P21, Hydrographic Oceanography
Iquique - Papeete
27 Mar - 15 May 1994

Leg 05

H. Bryden, Woods Hole Oceanographic Institution
(508) 548-1400 X2806
WOCE P21, Hydrographic Oceanography
Papeete - Brisbane
19 May - 25 June 1994

Leg 04
Michael McCartney, WHOI
Iquique - Papeete
27 Mar - 15 May 1994

Leg 05
Harry Bryden, WHOI
Papeete - Brisbane
19 May - 25 June 1994

Scientific Goals

It is proposed to carry out a transpacific hydrographic section along 17°S in an 87-day cruise during 1994. This section is part of a coordinated survey of the climate of the Pacific Ocean that is organized under the auspices of the World Ocean Circulation Experiment (WOCE) Hydrographic Program. The 17°S section was selected specifically to cross the South Pacific at the center of the subtropical gyre in the upper water circulation. In addition to contributing to the survey of the Pacific and to defining the subtropical gyre circulation, the motivation for the 17°S transpacific section is to determine the poleward ocean heat transport at the latitude where it is expected to be a maximum in the South Pacific and to investigate the thermocline circulation for comparison with ventilated thermocline theory.

The 17°S section proposed will consist of approximately 243 hydrographic stations, each consisting of a full-depth CTD (conductivity- temperature-depth) station providing continuous vertical profiles of temperature, salinity and oxygen and 36 water samples distributed throughout the water column which will be analyzed for salinity, oxygen and nutrients (nitrite, nitrate, phosphate and silicate). All measurements will be made to quality standards established by WOCE. Additional chemical tracer measurements such as tritium, helium, fluorocarbons, carbon dioxide, etc. will be made, but station time has not been scheduled for large-volume sampling for radiocarbon and argon. It is planned to analyze the measurements particularly for the thermocline circulation in the South Pacific, and to determine the meridional ocean heat transport across 17°S.

Overview (Sampling Plan)

We presently plan that WHP hydrographic section P21 (nominally at Lat. 17°S) across the South Pacific Ocean will begin in Iquique, Chile so that we will steam with the tradewinds westward across the Pacific. Because of the duration of the cruise and the size of the scientific party, R/V *Melville* will be the ship used for this section. After making test stations (in deep water) to verify equipment performance, we will steam northward along the coast to approximately 16°S and begin taking hydrographic stations along a line perpendicular to the isobaths out to 16° 45'S. The shallowest station will be taken in approximately 100 m of water near 14° 30'S, 76° 10'W. Each hydrographic station will consist of a full-depth conductivity- temperature-depth (CTD) cast with 36 water samples of 10-liter volume distributed throughout the water column. We will use a Neil Brown/EG&G CTD which measures temperature, conductivity, pressure and oxygen continuously (30 times per second) through the water column. Conductivity, temperature and pressure are then used to determine a continuous salinity profile. The water samples will be analyzed for salinity, oxygen and nutrients including nitrate, nitrite, phosphate and silicate. The salinity and oxygen analyses are used primarily for calibration of the continuous vertical profiles of salinity and oxygen taken by the CTD. The CTD measurements will be carried out by the Woods Hole Oceanographic Institution (WHOI) CTD Group, which is managed by Dr. John Toole. The salinity and oxygen analyses will be done by the Woods Hole Oceanographic Institution Hydro Group, managed by George Knapp. The nutrient analyses will be made by members of the Oregon State University (OSU) Nutrient Group, managed by Prof. Louis Gordon. All of these measurements can be carried out on water samples much smaller than 10 liters. Other chemical tracer measurements, e.g. tritium, helium and fluorocarbons are also planned and a standard sampling strategy at each station has been established. See Tables 1 and 2 for further information.

Melville will proceed westward across the Pacific along a latitude of 16° 45' taking stations at an average spacing of 30 nautical miles. Again, the WHP organizers have set the horizontal spacing for the Pacific survey to a standard of 30 nautical miles (nm) in order to resolve the mesoscale eddy variability

along each section. Roemmich, McCallister and Swift (1991) and Rintoul and Wunsch (1991) have demonstrated the importance of resolving the eddy variability for determining the meridional circulation and heat transport on zonal transoceanic hydrographic sections. Our interpretation of this standard is that 30 nautical miles should be the average station spacing for the section. We expect to take stations at spacing closer than 30 nm as we cross boundary currents and pass over significant topographic features, such as the continental slopes at either side of the section and the Tonga-Kermadec Ridge, and as we approach islands such as Fiji and New Caledonia. Our present intention is to take stations closer together than 30 nm whenever the bottom depth changes by 1000 m in less than 30 nm. To make up for these areas of denser stations, we plan to take stations in the mid-ocean regions at a station spacing of 40' of longitude (equal to 38 nm or 71 km). From a GEOSECS station at 17°S in the South Pacific, we estimate that the Rossby radius of deformation is 102 km. Thus, the planned station spacing of 71 km should be sufficient to resolve the mesoscale eddy variability.

At Long. 142°W the cruise track will be diverted south to Lat. 17° 30'S. We plan a very long first leg of 50 days duration for the transpacific section before a port stop in Tahiti. It is 5000 nm from Iquique to Tahiti and we plan 142 standard hydrographic stations along this eastern portion of the section.

The second leg of the section will immediately follow the eastern section, leaving Tahiti and continuing westward along 17° 30'S to Fiji. Stations will be taken in shallow water (about 100 m) off the Fiji coast. Beyond Fiji, we plan to angle southwestward to New Caledonia and then straight on to Sandy Cape, Australia at about 25°S, where the hydrographic section will end. Sampling will be conducted up to shallow water (approx. 100 m isobath) off New Caledonia and Australia. *Melville* will then steam to Brisbane) to complete the transpacific expedition. It is about 3800 nm from Tahiti to Brisbane and we plan to take 101 standard hydrographic stations on this second leg.

Station Positions for Transpacific Hydrographic Section Across 17°S

Station	Latitude	Longitude		Station	Latitude	Longitude
1	-15 30	-75 10	Test Station	25	-16 45	-76 00
2	-15 30	-75 10	" "	26	-16 45	-76 40
3	-15 30	-75 10	" "	27	-16 45	-77 20
4	-14 30	-76 10	Stations 4-13 for a section	28	-16 45	-78 00
5	-14 37.5	-76 15	north of the Nazca Ridge sill	29	-16 45	-78 40
6	-14 45	-76 20		30	-16 45	-79 20
7	-14 52.5	-76 25		31	-16 45	-80 00
8	-15 00	-76 30		32	-16 45	-80 40
9	-15 07.5	-76 35		33	-16 45	-81 20
10	-15 15	-76 40		34	-16 45	-82 00
11	-15 22.5	-76 45		35	-16 45	-82 40
12	-15 30	-76 50		36	-16 45	-83 20
13	-15 37.5	-76 55		37	-16 45	-84 00
14	-15 30	-75 10		38	-16 45	-84 40
15	-15 37.5	-75 15		39	-16 45	-85 20
16	-15 45	-75 20		40	-16 45	-86 00
17	-15 52.5	-75 25		41	-16 45	-86 40
18	-16 00	-75 30		42	-16 45	-87 20
19	-16 07.5	-75 35		43	-16 45	-88 00
20	-16 07.5	-75 35	Duplicate CTD	44	-16 45	-88 40
Station				45	-16 45	-89 20
21	-16 15	-75 40		46	-16 45	-90 00
22	-16 22.5	-75 45		47	-16 45	-90 40
23	-16 30	-75 50		48	-16 45	-91 20
24	-16 37.5	-75 55		49	-16 45	-92 00
				50	-16 45	-92 40
				51	-16 45	-93 20

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52	-16 45	-94 00	111	-16 45	-133 20	
53	-16 45	-94 40	112	-16 45	-134 00	
54	-16 45	-95 20	113	-16 45	-134 40	
55	-16 45	-96 00	114	-16 45	-135 20	
56	-16 45	-96 40	115	-16 45	-136 00	
57	-16 45	-97 20	116	-16 45	-136 40	
58	-16 45	-98 00	117	-16 45	-137 20	
59	-16 45	-98 40	118	-16 45	-138 00	
60	-16 45	-99 20	119	-16 45	-138 40	
61	-16 45	-100 00	120	-16 45	-139 20	
62	-16 45	-100 40	121	-16 45	-140 00	
63	-16 45	-101 20	122	-16 45	-140 40	
64	-16 45	-102 00	123	-16 45	-141 20	
65	-16 45	-102 40	124	-16 45	-142 00	
66	-16 45	-103 20	125	-16 45	-142 40	
67	-16 45	-104 00	126	-17 00	-142 50	Crossing island arc
68	-16 45	-104 40				
69	-16 45	-105 20	127	-17 15	-143 00	
70	-16 45	-106 00	128	-17 30	-143 10	
71	-16 45	-106 40	129	-17 30	-143 50	
72	-16 45	-107 20	130	-17 30	-144 30	
73	-16 45	-108 00	131	-17 30	-145 10	
74	-16 45	-108 40	132	-17 30	-145 30	Going over ridge
75	-16 45	-109 20	133	-17 30	-145 50	
76	-16 45	-110 00	134	-17 30	-146 30	
77	-16 45	-110 40	135	-17 30	-147 10	
78	-16 45	-111 20	136	-17 30	-147 50	
79	-16 45	-112 00	137	-17 30	-147 50	Duplicate CTD Cast
80	-16 45	-112 40				
81	-16 45	-113 20	138	-17 30	-148 30	
82	-16 45	-114 00	139	-17 30	-148 50	
83	-16 45	-114 40	140	-17 30	-149 00	
84	-16 45	-115 20	141	-17 30	-149 10	
85	-16 45	-116 00	142	-17 30	-149 20	
86	-16 45	-116 40		End of first leg at Tahiti		
87	-16 45	-117 20	143	-17 30	-147 50	
88	-16 45	-118 00	144	-17 30	-147 50	Duplicate CTD Cast
89	-16 45	-118 40				
90	-16 45	-119 20	145	-17 30	-149 55	
91	-16 45	-120 00	146	-17 30	-150 05	
92	-16 45	-120 40	147	-17 30	-150 20	
93	-16 45	-121 20	148	-17 30	-151 00	
94	-16 45	-122 00	149	-17 30	-151 40	
95	-16 45	-122 40	150	-17 30	-152 20	
96	-16 45	-123 20	151	-17 30	-153 00	
97	-16 45	-124 00	152	-17 30	-153 40	
98	-16 45	-124 40	153	-17 30	-154 20	
99	-16 45	-125 20	154	-17 30	-155 00	
100	-16 45	-126 00	155	-17 30	-155 40	
101	-16 45	-126 40	156	-17 30	-156 20	
102	-16 45	-127 20	157	-17 30	-157 00	
103	-16 45	-128 00	158	-17 30	-157 40	
104	-16 45	-128 40	159	-17 30	-158 20	
105	-16 45	-129 20	160	-17 30	-159 00	
106	-16 45	-130 00	161	-17 30	-159 40	
107	-16 45	-130 40	162	-17 30	-160 20	
108	-16 45	-131 20	163	-17 30	-161 00	
109	-16 45	-132 00	164	-17 30	-161 40	
110	-16 45	-132 40	165	-17 30	-162 20	

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166	-17 30	-163 00		223	-20 58	162 20	Airway Reef 100m
167	-17 30	-163 40		224	-21 05	162 00	Airway Reef 100m
168	-17 30	-164 20		225	-21 15	161 35	
169	-17 30	-165 00		226	-21 30	161 00	
170	-17 30	-165 40		227	-21 45	160 25	
171	-17 30	-166 20		228	-22 00	159 50	
172	-17 30	-167 00		229	-22 13	159 20	
173	-17 30	-167 40		230	-22 21	159 06	Nova Bank
174	-17 30	-168 20		231	-22 28	158 45	
175	-17 30	-169 00		232	-22 40	158 15	
176	-17 30	-169 40		233	-22 55	157 40	
177	-17 30	-170 20		234	-23 10	157 05	
178	-17 30	-171 00		235	-23 25	156 30	
179	-17 30	-171 40		236	-23 40	155 55	
180	-17 30	-172 20		237	-23 55	155 20	
181	-17 30	-172 40	Extra Station Over Trench	238	-24 10	154 45	
				239	-24 10	154 45	Duplicate Deep CTD Station
182	-17 30	-173 00		240	-24 25	154 10	
183	-17 30	-173 40		241	-24 35	153 45	
184	-17 30	-174 20		242	-24 42	153 32	
185	-17 30	-175 00		243	-24 48	153 20	Sandy Cape Australia
186	-17 30	-175 40					
187	-17 30	-176 20					
188	-17 30	-177 00					
189	-17 30	-177 40					
190	-17 30	-178 20					
191	-17 30	-179 00					
192	-17 30	-179 40					
193	-17 30	179 40					
194	-17 30	179 05					
195	-17 30	178 55					
196	-17 30	178 47	Fiji				
197	-17 30	177 00					
198	-17 30	177 20					
199	-17 30	176 40					
200	-17 30	175 00					
201	-17 30	174 20					
202	-17 30	173 40					
203	-17 30	173 00					
204	-17 30	172 20					
205	-17 30	171 40					
206	-17 30	171 00					
207	-17 30	170 20	Begin to angle for Sandy Cape				
208	-17 45	169 45					
209	-18 00	169 10					
210	-18 15	168 35					
211	-18 30	168 00					
212	-18 45	167 25					
213	-19 00	166 50					
214	-19 15	166 15					
215	-19 30	165 40					
216	-19 45	165 05					
217	-19 55	164 41					
218	-20 02	164 25	New Caledonia				
219	-20 19	163 52					
220	-20 28	163 29					
221	-20 38	163 06					
222	-20 48	162 43					

Station positions are preliminary, and may be altered depending on contingencies as the cruise progresses.

Scientific party: Leg 04:

1. Mr. Brian J. Guest, Hardware Technician/Watch stander, WHOI
2. Mr. George P. Knapp, Hydrographer, WHOI
3. Dr. Michael S. McCartney, Chief Scientist, WHOI
4. Mr. Ronald Moe, Programmer, UCSD/SIO/STS
5. Mr. Eugene Pillard, Resident Technician, UCSD/SIO/STS
6. Mr. H. Marshall Swartz, Hardware Technician/Watch stander, WHOI
7. Mr. George H. Tupper, Hydrographer, WHOI
8. Ms. Sarah Zimmerman, Data Processor, WHOI
- 9.-13. To be determined, WHOI
- 14.-27. To be determined, Non-WHOI

Scientific party: Leg 05

TBD

UNDERWAY GEOPHYSICAL DATA ACQUISITION PLAN

Date revised 19 Oct 1993
By: S.M. Smith

LEG: Westward, Leg 4 (WEST04MV) [WOCE P21] R/V Melville

DATES: (and ship-days): 27mar-15may94 (55 days)

PORTS: Iquique, Chile - Papeete, Tahiti

CHIEF SCIENTIST(S): H. Bryden, M. McCartney, WHOI

FOREIGN CLEARANCES REQUESTED FOR: Peru & France

UW DATA COLLECTION (yes/no) DAYS PAID FOR; RATE and FUNDING SOURCE

___ Depth, 12kHz (analogue,wide) (included in daily ship rate)

___ Depth, 3.5kHz (analogue,wide) (included in daily ship rate)

no Magnetics (included in daily ship rate)

no Gravity

no Seismic Reflection, Analogue

no Seismic Reflection, Digital

yes SEA BEAM 2000 with sidescan:

Collection Mode (one only):

___ Full Rate w/ processor

___ Full Rate w/o processor

___ Intermittent use mode

x Non G&G Ancillary

50 days @ \$500/day requested from NGDC/DMA

20 days @ \$250/day requested from NSF by D.Sandwell

DATA SHIPMENT AT END OF LEG: Retain onboard and ship back to SIO/GDC at end of leg 5.
(air freight at STS expense or van?)

NOTES:

Contact:

Stuart M. Smith

Head, Geological Data Center (0223)

Scripps Institution of Oceanography

9500 Gilman Drive

La Jolla, CA 92093-0223

Phone: (619) 534-2752

Fax: (619) 534-5306

Internet email: ssmith@ucsd.edu

UNDERWAY GEOPHYSICAL DATA ACQUISITION PLAN

Date revised 19 Oct 1993
By: S.M. Smith

LEG: Westward, Leg 5 R/V (WEST05MV) [WOCE P21] R/V *Melville*

DATES: (and ship-days): 19may-25jun94 (40 days)

PORTS: Papeete, Tahiti - Brisbane, Australia

CHIEF SCIENTIST(S): H. Bryden, M. McCartney, WHOI

FOREIGN CLEARANCES REQUESTED FOR: France, Australia, N. Zealand, Vanuatu,
Fiji, and Tonga

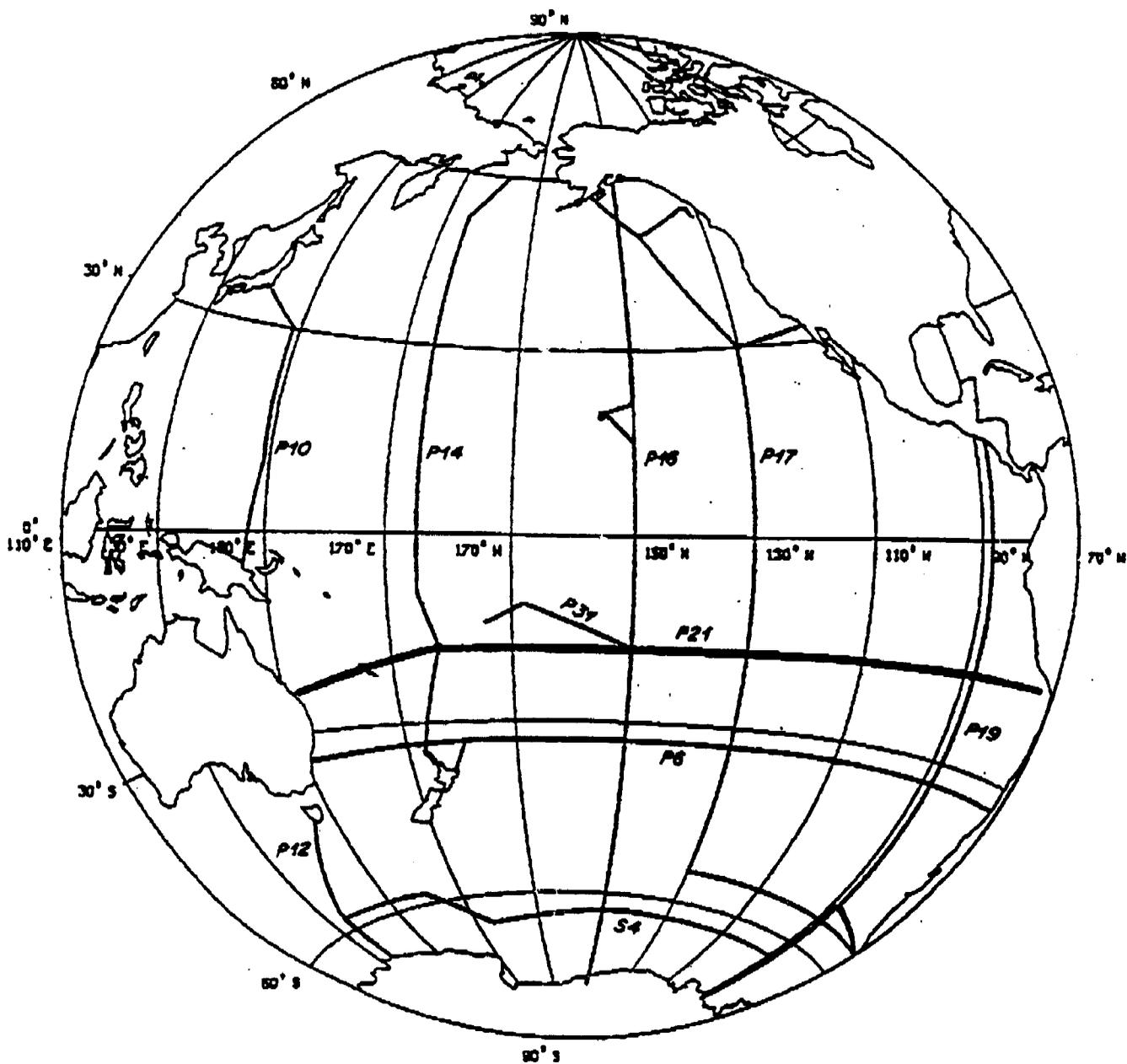
UW DATA COLLECTION (yes/no)	DAYS PAID FOR; RATE and FUNDING SOURCE
<input type="checkbox"/> Depth, 12kHz wide beam	(included in daily ship rate)
<input type="checkbox"/> Depth, 3.5kHz wide beam	(included in daily ship rate)
no Magnetics	(included in daily ship rate)
no Gravity	
no Seismic Reflection, Analogue	
no Seismic Reflection, Digital	
yes SEA BEAM 2000 with sidescan:	
Collection Mode (one only):	\$500/day for 37 days requested from NGDC/DMA
<input type="checkbox"/> Full Rate w/ processor	
<input type="checkbox"/> Full Rate w/o processor	
<input type="checkbox"/> Intermittent use mode	
<input checked="" type="checkbox"/> Non G&G Ancillary	

DATA SHIPMENT AT END OF LEG: Ship back to SIO/GDC (air freight or van?)

NOTES:

Contact:
Stuart M. Smith
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9500 Gilman Drive
La Jolla, CA 92093-0223
Phone: (619) 534-2752
Fax: (619) 534-5306
Internet email: ssmith@ucsd.edu

U.S. PACIFIC WOCE



Cruise Track: Along line P21 from east (Peru) to west (Australia) with the wind.

Mailing Address For R/V MELVILLE 1994/95

All mail and/or shipments should be sent to the agent's address. Address should include the name of the person, the name of the ship, the name of the agent and the agent's address. Also, all mail should be marked: "PLEASE HOLD FOR ARRIVAL OF R/V MELVILLE." All air freight shipments must be marked: "SPARE PARTS (OR SCIENTIFIC EQUIPMENT) IN TRANSIT FOR MASTER, R/V MELVILLE", care of agent.

PORT DATES	PORTS	AGENT'S NAME AND ADDRESS
30 DEC 93 03 JAN 94	PAPEETE Tahiti	Papeete Seairland Transports P.O. Box 4536 Papeete, Tahiti TEL: 011-689-428307 FAX 011-689-430711 TELEX: 285 FP Contact: Jim Hostettler
08 FEB 94 14 FEB 94	WELLINGTON New Zealand	Burns Phillip Shipping (NZ)Ltd. P.O. Box 3545 Wellington, NZ TEL: 011-64-4-449-6669 FAX: 011-64-4-499-6629 TELEX: NZ 30067 Contact: Jim Hall
21 MAR 94 27 MAR 94	IQUIQUE Chile	A.J. Broom Y Cia. S.A.C. Blanco 951, Casilla 910 Valparaiso TEL: 011-56-32-251001 FAX: 011-56-32-213308 TELEX: 230016 Contact: Ops Dept
15 MAY 94 19 MAY 94	PAPEETE Tahiti	<u>Same as Above</u>
25 JUNE 94 29 AUG 94	BRISBANE Australia	Dalgety Shipping P.O. Box 503 Hamilton Central, Qld. 4007 TEL: 011-61-7-268-7488 FAX: 011-61-7-268-7781 TELEX: 40275 Contact: Vaughan Hymas

29 September 1993