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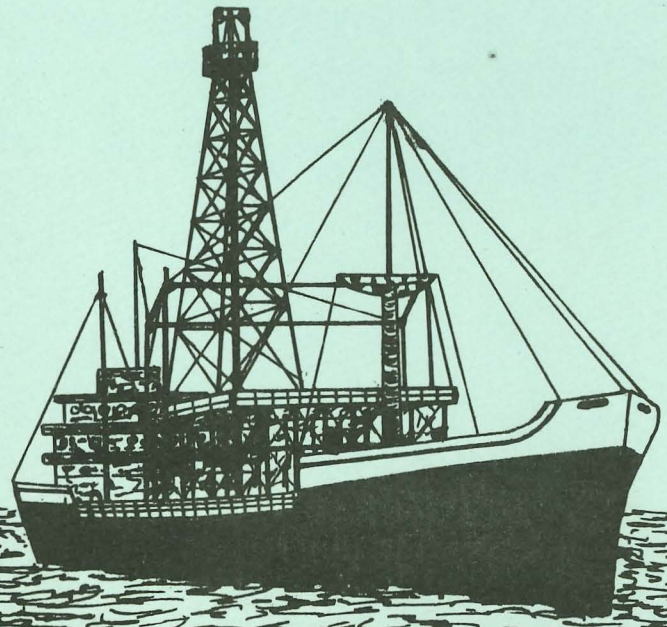
Minerals Availability System

INITIAL REPORT OF THE
1972 SEA SCOPE EXPEDITION
VOLUME I

Compiled and Edited by
J. Greenslate, M. Krutein,
and D. Pasho

Prepared for
U.S. Bureau of Mines
(Minerals Availability System)
Spokane, Washington

March 1978



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U.S. BUREAU OF MINES — UNITED STATES DEPT. OF THE INTERIOR

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All views and conclusions contained in this document are those of the editors and should not be interpreted as necessarily representing the official policies or recommendations of the Interior Department's Bureau of Mines or of the U.S. Government.

PREFACE

This report was compiled for the Western Field Operation Center of the U.S. Bureau of Mines under a purchase order agreement (P-4470179) with Dr. J. Greenslate, Research Oceanographer, Scripps Institution of Oceanography, La Jolla, California. Work commenced on April 15, 1977 and continued intermittently through May 31, 1978.

The primary objective was to provide basic mineral resource data to be used in making deep ocean mineral resource evaluations as input into the Bureau's Mineral Availability System (MAS). Secondary objectives were to preserve the voluminous records of the 1972 Sea Scope Expedition before they were lost, destroyed or fragmented to the extent they would lose their scientific validity; and to compile the pertinent material into a usable document for the Bureau of Mines and others involved in deep sea mineral resource investigation.

The basic content of this report was generated by the many scientists, technicians, and seamen who participated in the Sea Scope nodule exploration program. The fact that names fail to be associated with material to which specific individuals made significant contributions is intended to protect them from responsibility for the content of this document in its now edited form. Their work could not be properly referenced since it remains unpublished. No credit should be given the editors for generating the data contained herein. They must accept responsibility for any errors or misinterpretations that may be present, however. Typing of the manuscript was done principally by Michiko Hitchcox. Her attention to detail was an invaluable contribution.

R. D. Weldin and C. T. Hillman of the Western Field Operation Center provided the specifications for the project, monitored its progress, and reviewed the final documents for completeness. Dr. Greenslate was charged with acquiring the information, obtaining permission for its dissemination or publication, and assembling the data into a convenient yet comprehensive form.

J. Greenslate, Ph.D.
Scripps Institution of Oceanography

Manfred Krutein
Irvine, California

David Pasho
Energy, Mines & Resources, Canada

Volume I

Initial Report of the 1972 Sea Scope Expedition

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INITIAL REPORT OF THE 1972 SEA SCOPE EXPEDITION

INTRODUCTION

Several private companies in the United States and other countries are interested in ocean mining and a potential utilization of marine deposits of manganese nodules from the northern part of the Pacific Ocean. In the early 1970s Hughes Tool Company was among these firms. Many questions about distribution of manganese nodules, nodule quality with regard to economically extractable metals, water depths, bathymetry and sea floor characteristics in potential deposit areas could not be answered satisfactorily with existing public data. It was decided during 1971 to obtain the answers by conducting a survey.

Global Marine Development, Inc. (GMDI), New Port Beach, California, a subsidiary of Global Marine, Inc., was contacted and assigned the task of planning and conducting a survey. Manfred G. Krutein, Manager Ocean Mining Technology, was in charge of planning and preparing the survey in accordance with instructions of the customer. Six (6) legs, with specific tasks, were planned. However, Leg 4 had to be cancelled because of time lost for engine repair early in the survey. David W. Pasho, Chief Scientist for the survey operation, worked out detailed plans and was responsible for the scientific aspects of the survey. Captain Miles, Captain Thompson and personnel of GMDI were responsible for the operation and safety of the vessel.

GMDI personnel conducted the survey and operated the research vessel "Sea Scope," which was leased for the project. The survey began 6 February 1972 and terminated on 31 July 1972.

Reports about scientific aspects of the survey were prepared by David W. Pasho and approved by Manfred G. Krutein during 1972. They were edited for this report by J. Greenslate in 1978.

This report is presented in three basic sections: Volume I, Summaries; Volume II, Technical Appendices; and Volume III, Detailed Station Records. The first section gives an overview of each of the five legs including some of the more significant findings and events.

It is intended for non-scientists and managers who do not care to be burdened with specific detail about the procedures and analytical results. It also serves as a guide to the expedition archives. The second section, Technical Appendices, describes the operational and or analytical procedures that were used during the program. The third and final section, Detailed Station Records, contains a summary of all the quantitative data that was generated during the course of this exploration. Presented in station number sequence, it contains detailed data for each and every station visited during the Sea Scope Expedition.

We recognize that the above divisions are arbitrary and that many readers will be interested in more than one section. The divisions are a matter of convenience only; this report would be incomplete were any material in any section omitted. The reader must also keep in mind that much of the original data, especially the bathymetric records, are not present in printed form. They can only be acquired in microfilm form as referenced later in this report.

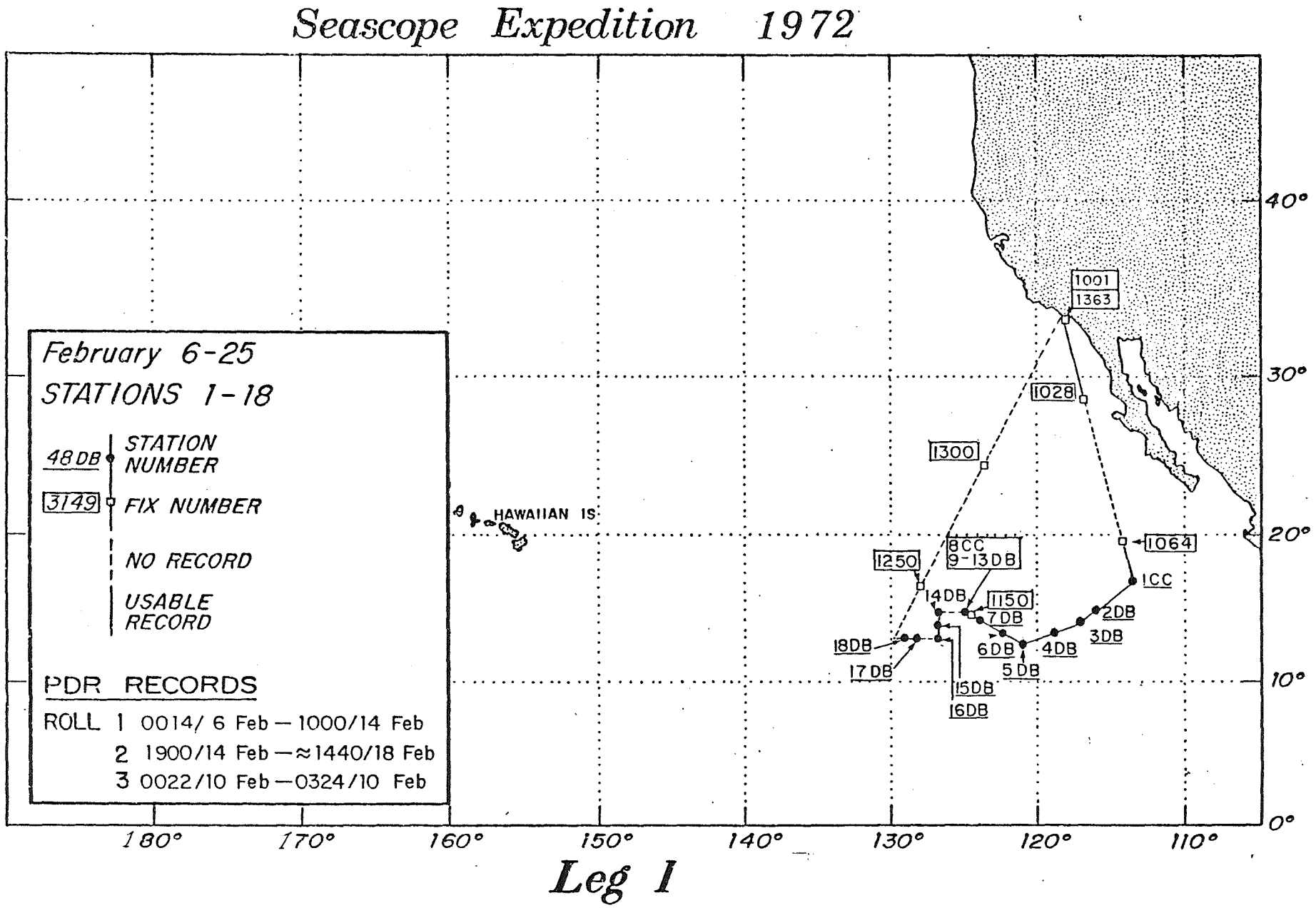

Seascope Expedition 1972
February 6-25
STATIONS 1-18
48DB
STATION NUMBER
3149
FIX NUMBER
NO RECORD
USABLE RECORD
PDR RECORDS
ROLL 1 0014/ 6 Feb — 1000/14 Feb
2 1900/14 Feb — ≈1440/18 Feb
3 0022/10 Feb — 0324/10 Feb
HAWAIIAN IS
1001
1363
1028
1300
1064
1250
8CC
9-13DB
1CC
14DB
1150
7DB
2DB
3DB
18DB
6DB
4DB
17DB
5DB
15DB
16DB
40°
30°
20°
10°
0°
180°
170°
160°
150°
140°
130°
120°
110°
Leg 1

Figure 1

Leg 1

On 6 February 1972, the Sea Scope departed from San Pedro, California. The first station was made on 10 February 1972. On 18 February, as a result of engine trouble, the leg was terminated early; the Sea Scope returned to Long Beach on 25 February. A map of the cruise track and stations is included as Figure 1; the cruise chronology follows.

Leg 1 Chronology

Date (GM)	Time (GM)	Commence Activity
6 Feb	0015	San Pedro: Underway
9 Feb	1935	Pinger Monitoring Experiment
10 Feb	0000	Station SS72 - 1 CC
10 Feb	0530	Underway
11 Feb	0330	Maneuvering for Dredge
	0400	Station SS72 - 2 DB
	0800	Underway
	1445	Maneuvering for Dredge
	1530	Station SS72 - 3 DB
	1930	Underway
12 Feb	0720	Maneuvering for Dredge
	0735	Station SS72 - 4 DB
	1300	Underway
13 Feb	0110	Maneuvering for Dredge
	0125	Station SS72 - 5 DB
	0530	Underway
	1310	Maneuvering for Dredge
	1415	Station SS72 - 6 DB
14 Feb	0100	Maneuvering for Dredge
	0115	Station SS72 - 7 DB
	0640	Underway
	1545	Maneuvering for Dredge
	1900	Station SS72 - 8 CC
	2300	Underway

Date (GM)	Time (GM)	Commence Activity
15 Feb	0040	Station SS72 - 9 DB
	0455	Underway
	0520	Station SS72 - 10 DB
	0935	Underway
	1000	Station SS72 - 11 DB
	1530	Underway
	1745	Station SS72 - 12 DB
	2230	Underway
16 Feb	0020	Station SS72 - 13 DB
	0420	Underway
	1255	Maneuvering for Dredge
	1310	Station SS72 - 14 DB
	1630	Underway
	2145	Station SS72 - 15 DB
17 Feb	0135	Underway
	0700	Station SS72 - 16 DB
	1155	Underway
	2305	Station SS72 - 17 DB
18 Feb	0430	Underway
	1505	Maneuvering for Dredge
	1535	Station SS72 - 18 DB
	2005	Underway
	2012	C/C for California
24 Feb	----	In Port

Objectives and Synopsis

The objectives of Leg 1 were a) locate "flat" noduliferous areas, b) recover a large volume of nodules of good quality for use in processing tests and c) obtain physical samples of nodules at intervals to further delineate high grade regions.

Rough seas and the inability of the Precession Depth Recorder (PDR) to yield a good bottom record under these conditions precluded locating

flat areas during the latter part of the leg. Prior to that, a single "flat" area was located but bottom photographs showed no nodule cover.

Volume recovery was undertaken by continuous dredging at a site with a dense cover of good quality nodules. Additional volume was contributed by the use of the drag box in taking regular interval samples. A total of approximately 1-1/2 tons (wet weight) of moderate quality nodules were recovered. (See section on sample inventory for breakdown)..

The drag box proved satisfactory for obtaining a physical sample at regular intervals. It does not, however, yield information on the density of nodule coverage and the operation is somewhat more time consuming than a spade coring or camera operation would be.

Although difficulties were encountered, Leg 1 was considered as being successful. Samples were taken as planned and, even though terminated early, a good quantity of what appears to be quality nodules were recovered. The major disappointment was not locating flat areas with nodules; this failure was due primarily to poorly functioning PDR equipment and should not be construed to mean that flat areas do not exist in the surveyed area. All problems encountered on this leg were related to equipment failure and were corrected prior to the start of Leg 2.

Operations Summary

The ship logged 3700 nautical miles during Leg 1. Between 10 and 18 February, 18 stations were occupied; two of them were for camera lowerings and sixteen for dredging.

The camera station results were:

SS72-1CC	9 good frames showing nodules
SS72-8CC	5 good frames showing nodules

The drag box dredging results were:

Total Time (hrs)	High	Low	Average
Total Time (hrs)	5-1/2	3-1/2	4-1/2
Depth (meters)	4758	3979	4350
Line Out (meters)	7500	6000	7100
Scope	1.74	1.51	1.63

Bottom Time (hrs)	2-1/2	1/2	4-1/2
Ship Speed	4 kn	Drift∿1 kn	1-2 kn
Weight of Nodules (lbs) Recovered (16 lowerings)	670	0	230
Weight of Nodules (lbs) Recovered (12 lowerings)	670	1	275

Data and Samples Summary

As noted above, the PDR equipment functioned poorly on Leg 1. Nevertheless, there were some useful bathymetric data collected. Records were taken continuously whenever the ship was underway. Gaps in the records known to exist at the conclusion of Leg 1 are:

6 February	02XX - 1600
8 February	2100 - 2400
9 February	0200 - 0400
11 February	1400 - 2000
16 February	1806 - 2400
17 February	0000 - 2300

Should other gaps be found in the archived records they are due to post-cruise accidental loss. All original PDR records with the corresponding navigational data can be found in microfilm archives deposited with the Environmental Data Service (EDS) of the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce. Anyone interested in examining these data should contact:

National Geophysical and Solar-Terrestrial
Data Center
Boulder, Colorado 80302

and ask for microfilm records of the 1972 Sea Scope Expedition.

The cumulative sample inventory for Leg 1 is:

Nodules:	69 burlap bags, total weight 3594 lbs
	39 vials nodule powder (analysis)
	39 vials nodule powder (reference)
Sediment:	7 plastic bags
Organisms:	7 jars

The nodules in burlap bags have been deposited with the U.S. Bureau of Mines in Salt Lake City, Utah.

The 39 vials of powdered nodule (representative splits from the dredges) for analysis were consumed to produce the data appearing later in this report. The 39 vials of reference powder are archived with Dr. J. Greenslate of Scripps Institution of Oceanography. The sediment samples have been lost.

The 7 jars of organisms are archived with Dr. William A. Newman of Scripps Institution of Oceanography. Samples should be identified with additional information from the station logs prior to requesting specimens.

All available original bottom photography negatives are on deposit with EDS as part of the permanent microfilm record.

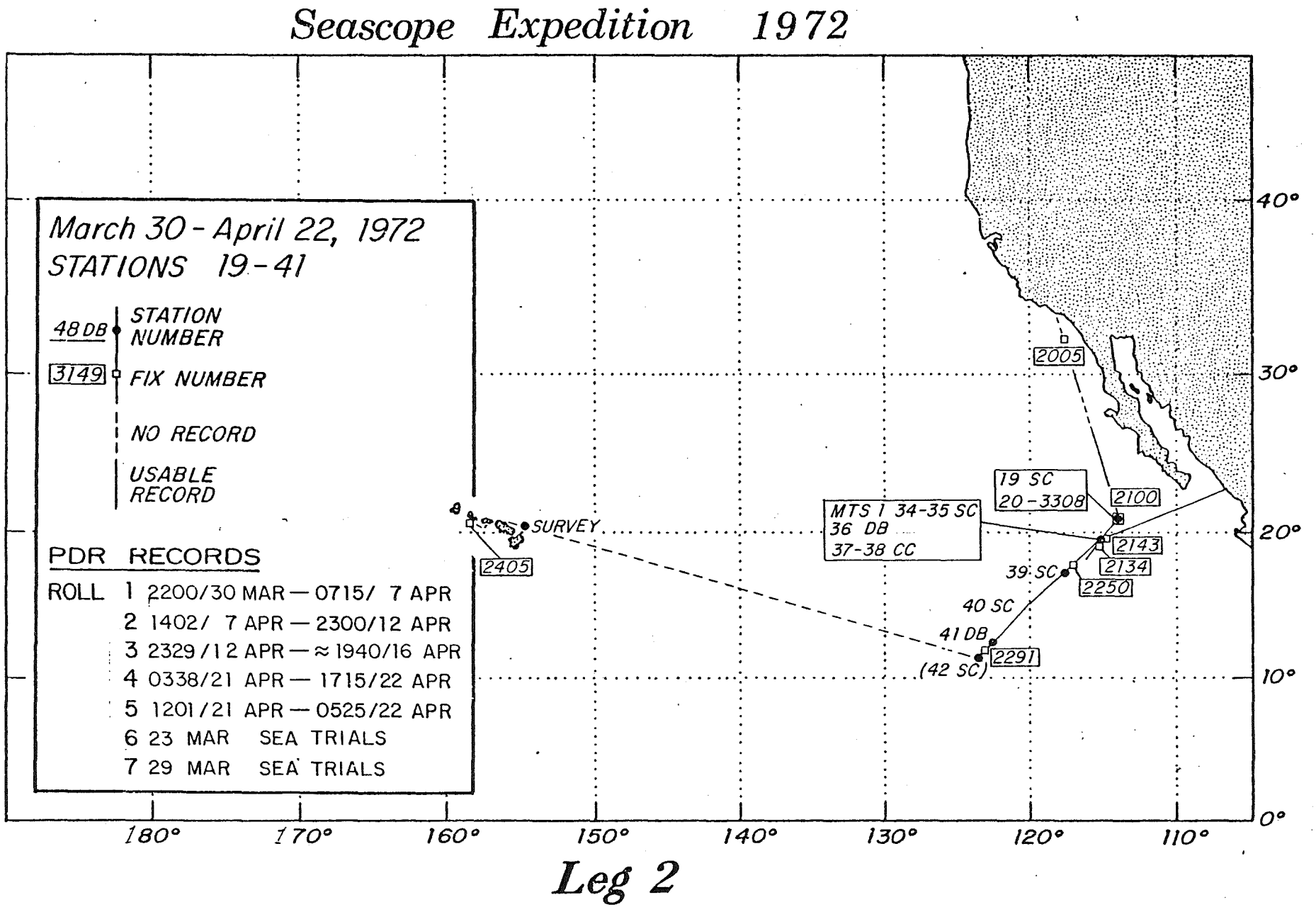

Seascope Expedition 1972
March 30 - April 22, 1972
STATIONS 19-41
48 DB
STATION NUMBER
3149
FIX NUMBER
NO RECORD
USABLE RECORD
PDR RECORDS
ROLL 1 2200/30 MAR — 0715/ 7 APR
2 1402/ 7 APR — 2300/12 APR
3 2329/12 APR — ≈ 1940/16 APR
4 0338/21 APR — 1715/22 APR
5 1201/21 APR — 0525/22 APR
6 23 MAR SEA TRIALS
7 29 MAR SEA TRIALS
SURVEY
2405
2005
19 SC
20-3308
2100
MTS 1 34-35 SC
36 DB
37-38 CC
2143
2134
39 SC
2250
40 SC
41 DB
2291
(42 SC)
40°
30°
20°
10°
0°
180°
170°
160°
150°
140°
130°
120°
110°
Leg 2

Figure 2

LEG 2

Leg 2 took place from 30 March to 22 April 1972 departing from San Pedro, California. From 2 April to 6 April, drag box testing was conducted in a preselected area off Baja California. After completion of these tests, regular interval sampling was conducted until 7 April when it was necessary to cruise to Mazatlan to pick up winch parts. On 7 April, during the cruise to Mazatlan, Mexico, to pick up winch parts. On 7 April, during the MTS#1) was undertaken. The ship arrived at and departed from Mazatlan on 9 April. On 11 and 12 April, during the return to the cruise track, samples were taken in the area of SS72 MTS #1. Regular interval sampling commenced on 13 April. On 15 April, while taking a spade core sample, the winch brake failed. The sampling equipment and all wire line were lost. A course was laid to Honolulu, Hawaii

On 21 April, a brief bathymetric survey was conducted in deep water east of Hawaii. Similar shallower water surveys were performed southeast and south of Maui and northwest of Hawaii. The cruise terminated in Honolulu on 22 April.

A map of the cruise track and stations is included as Figure 2; the cruise chronology follows.

Leg 2 Chronology

Date (GM)	Time (GM)	Commence Activity
30 Mar		Leave San Pedro
2 Apr	1230	Survey and test drag boxes, stations 19SC, 20-33DB
6 Apr	0100	Underway
	0843	Station 34SC
	1300	Underway
	2130	Station (aborted)
7 Apr	0000	Underway to Mazatlan
	0840	Survey of MTS #1
	1414	Continue to Mazatlan

Date (GM)	Time (GM)	Commence Activity
9 Apr	1120	Arrive Mazatlan
	1800	Depart Mazatlan
11 Apr	1520	Sampling in MTS #1 Stations 35SC 36DB, 37CC, 38CC
12 Apr	1140	Underway
13 Apr	0400	Station 39SC
	0600	Underway
14 Apr	0150	Station 40SC
	0410	Underway
	2000	Station 41DB
15 Apr	0100	Underway
	0900	Station (aborted)
	0930	Lost spade core and line, underway to Honolulu
21 Apr	1200	Surveying for test sites off Hawaii and Maui
22 Apr	1200	Arrived Honolulu

Objectives and Synopsis

The objectives of Leg 2 were a) to test various drag box configurations to discover the design yielding the highest recovery of nodules per haul, b) to locate flat noduliferous areas and c) to obtain physical samples of nodules at intervals to further delineate high grade regions.

A summary of the drag box testing is presented in Appendix B.

During the cruise, one relatively flat nodule-covered area was located at approximately 19°40'N, 115°18'W and designated SS72 MTS #1. While further work remains to be done, it appears to be an area of perhaps 4 to 9 km^2 with less than 10 fathoms (60 feet) of relief. Nodule coverage is low, approximately 10-15 percent. The majority of nodules are from 2 to 4 inches in diameter.

Regular interval samples were taken with drag box and spade core at all subsequent stations.

Three brief bathymetric surveys were conducted off Hawaii and Maui searching for acceptable equipment test sites. One was in approximately 18,000 feet of water east of Hawaii at 20°30'N, 154°10'W. Three areas, one east of the southeast coast of Maui in water 5000 to 6000 feet deep, another northwest of Hawaii in depths from 3000 to 6000 feet and the last south of Maui in 5000 to 6000 feet were crossed in searching for an intermediate depth test site. A narrow but relatively level terrain was located approximately 30 miles east of the southeast coast of Maui; more work including sampling would be necessary to establish it as acceptable. Neither of the last two areas yielded any possible sites.

With the exception of loss of the spade core and poor PDR system performance there were no severe problems encountered on Leg 2. Problems of bad-to-nonexistent PDR records while cruising could only be overcome by slowing the ship to 5 to 7 knots and towing an improvised fish. This practice was not followed because of excessive time loss.

Operations Summary

The ship logged 4600 nautical miles during Leg 2. Between 2 and 14 April, 23 stations were occupied; two of them were for camera lowerings, five for spade coring, and sixteen for dredging.

The camera station results were:

SS72-37CC	Many excellent frames
SS72-38CC	Many excellent frames

The spade coring results were:

SS72-19SC	Full core with surface nodules Bottom photos taken
SS72-34SC	Full core with surface nodules
SS72-35SC	Full core with subsurface nodules only
SS72-39SC	Full core with surface nodules
SS72-40SC	No sample - mid-water trip

The drag box dredging results are reported in the appendices.

The area surveys yielded quantitative data only. No bathymetric charting was attempted because of poor navigational control.

Data and Samples Summary

The original PDR records with corresponding navigational data can be found on microfilm archives deposited with EDS as referred to for Leg 1. There are no usable records whenever ship speed exceeded 7 knots. Known gaps in the records include:

7 April	0715 - 1402
12 April	2300 - 2329
16 April to 21 April	1940 - 0338

Should other gaps be found in the archived records they are due to post-cruise accidental loss.

The cumulative sample inventory for Leg 2 is:

Nodules:	83 burlap bags, total weight 4102 lbs
	20 sample bags
	21 vials nodule powder (analysis)
	21 vials nodule powder (reference)
Sediment:	35 plast ic bags
Organisms:	1 jar

The disposition of samples for Leg 2 is the same as that for Leg 1 except that the 20 sample bags of nodules have been lost.

All available original bottom photography negatives are on deposit with EDS as part of the permanent microfilm record.

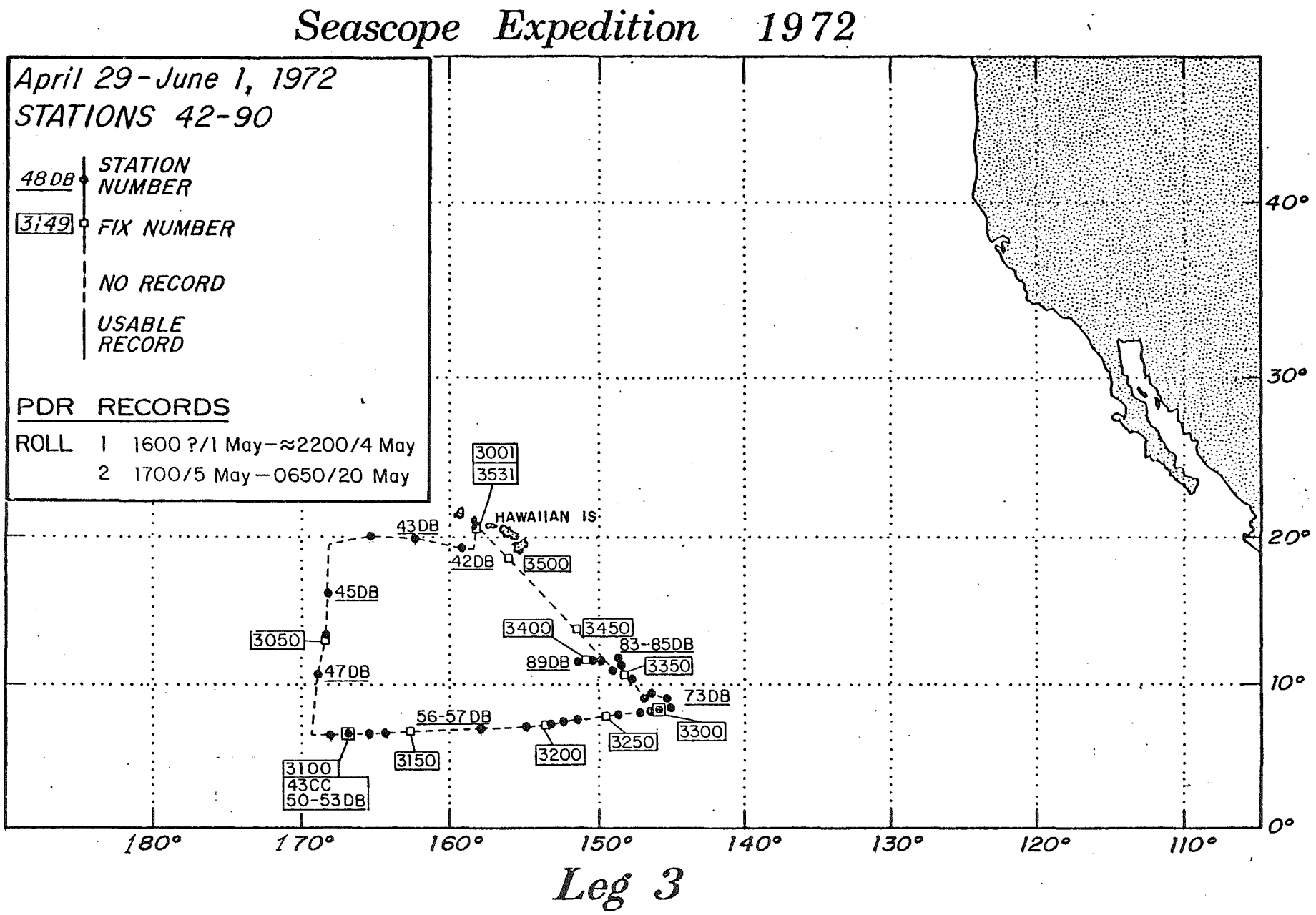

Seascope Expedition 1972
April 29 - June 1, 1972
STATIONS 42-90
48DB STATION NUMBER
3149 FIX NUMBER
NO RECORD
USABLE RECORD
PDR RECORDS
ROLL 1 1600 ?/1 May - ≈2200/4 May
2 1700/5 May - 0650/20 May
3001
3531
HAWAIIAN IS
43DB
42DB
3500
45DB
3050
3400
3450
83-85DB
89DB
3350
47DB
73DB
56-57DB
3300
3250
3200
3150
3100
43CC
50-53DB
180°
170°
160°
150°
140°
130°
120°
110°
40°
30°
20°
10°
0°
Leg 3

Figure 3

LEG 3

Leg 3 of the Seascope 1972 Exploration Program lasted from 28 April to 1 June, 1972 departing Honolulu, Hawaii. From 30 April to 26 May, regular interval sampling was conducted. In addition, a mining test site survey (MTS #2) was made and the area was densely sampled. Leg 3 dredging operations were particularly productive producing 19 475 lbs of nodule samples.

The cruise terminated at Honolulu, Hawaii on 1 June 1972.

A map of the cruise track and stations is included as Figure 3; the cruise chronology follows.

Leg 3 Chronology

Date (GM)	Time (GM)	Commence Activity
28 Apr	1030	Departed Pier 10, Honolulu
29 Apr	0014	Stations 42DB, 43DB (Sites #1 and #2)
1 May	0057	Underway
	0857	Stations 44DB, PDR out (Site #3)
	1240	Underway
3 May	1550	Station 45DB (Site #4)
	1950	Underway
4 May	1800	Station 46DB (Site #5)
	2155	Underway
5 May	0830	Station 47DB (Site #6)
	1130	Underway
7 May	1800	Station 48DB (Site #7)
	2130	Underway
8 May	0318	Station 49CC through
	2208	Station 53DB (Site #8)
9 May	1232	Underway
10 May	0234	Station 54 DB (Site #9)
	0730	Underway
	1505	Station 55DB (Site #10)
	2002	Underway

Date (GM)	Time (GM)	Commence Activity
12 May	2032	Station 56CC (Site #11)
13 May	0115	Underway
	0148	Station 57DB (Site #12) through Station 58DB (Site #13)
	2112	Underway
14 May	0520	Station 59DB (Site #14) through Stations 60DB, 61DB (Site #15)
15 May	0630	Underway
	1939	Stations 62CC, 63DB (Site #16)
16 May	0702	Underway
	2233	Station 64DB (Site #17)
17 May	0310	Underway
	1330	Stations 65DB, 66DB, 67PC-PGC Station 68DB (Site #18)
18 May	0852	Underway
18 May	1837	Station 69DB (Site #19)
19 May	0020	Underway
	0850	Station 70DB (Site #20)
	1305	Underway
	2354	Stations 71DB, 72DB (Site #21)
20 May	0730	Underway
	2108	Station 73DB (Site #22)
21 May	0040	Underway
	0621	Station 74DB (Site #23)
	0955	Underway
	1130	Station 75CC (test) (Site #24)
	1215	Underway
	1854	Stations 76PC, 77DB, 78DB (Site #25)
22 May	0655	Underway
	1706	Stations 79DB, 80DB, 81DB, 82CC (Site #26)
23 May	1436	Underway
	2200	Stations 83DB, 84DB, 85DB (Site #27)

Date (GM)	Time (GM)	Commence Activity
24 May	1335	Underway
	1705	Stations 86DB, 87DB (Site #28)
25 May	0210	Underway
	0700	Station 88DB (Site #29)
	1135	Underway
	2108	Station 89DB (Site #30)
26 May	0220	Underway
	0720	Station 90DB (Site #31)
	1214	Winch engine problem, underway to Honolulu
1 Jun	----	Arrive Honolulu

Objectives and Synopsis

The objectives of Leg 3 were a) locate flat nodule bearing areas, b) recover large volumes of nodules at representative sites and c) obtain nodule samples at regular intervals to evaluate regional ore grade characteristics.

Based upon information available, regions which were thought likely to contain flat areas were preselected. On-site monitoring was then conducted with the PDR (model UQN/1) unit (see Appendix A).

Stations 69DB through 74DB appeared to be in a region of rather consistent depths, indicating a good chance of subdued topography. A large volume of nodules of good quality were obtained.

A region in which nodule recovery was high was selected for a site survey (MTS #2). While a completely satisfactory depth record could not be obtained from the UQN/1, it appears that a 9 nautical mile square area was located in which the total relief is less than 60 fathoms.

Regular sampling was done on our track at intervals of between 60 and 200 nautical miles (except for a 400 mile break across the Line Islands while the A-frame was under repair). Dredging with the Type "E" drag box was very successful.

The results of Leg 3 are extremely valuable in terms of remarkable nodule recovery and successes with the dredge, the sonar fish and the

piston core. The attempts to locate, survey and sample more flat areas were frustrated because of depth sounding gear failure.

Operations Summary

The ship logged 2600 nautical miles during Leg 3. In all, 49 stations were occupied; five were for camera lowerings, two for piston coring, and forty-two for dredging.

The camera station results were:

SS72-49CC	240 excellent frames
SS72-56CC	Some frames of poor quality
SS72-62CC	Poor exposures - no bottom data
SS72-82CC	No bottom photos

The piston coring results were:

SS72-67PC	No core - mid-water trigger
SS72-76PC	Ten feet of core-nodule on top

The drag box dredging yielded 34 successful samplings out of the 42 attempts. The recovery is summarized as:

Pounds nodules	Number of Station
0 - 10	11
10 - 100	8
100 - 500	11
500 - 1000	5
1000 - 1500	1
1500 - 2000	4
over 2000	2

Data and Samples Summary

All original PDR records with corresponding navigational data can be found on microfilm archives deposited with EDS as referred to for Leg 1. There are no usable records whenever ship speed exceeded 7 knots. Known gaps in the records include:

28 April to 1 May	1030 - ∿1600
4 May to 5 May	∿2200 - ∿1700
20 May to 1 June	0650 - ∿1200

Should other gaps be found in the archived records they are due to post-cruise accidental loss.

The cumulative sample inventory for Leg 3 is:

Nodules:	394 burlap bags, total weight 19,475 lbs
	32 sample bags, total weight 391 lbs
	32 vials nodule powder (analysis)
	32 vials nodule powder (reference)
Sediments:	5 plastic bags
Organisms:	4 jars

The disposition of samples for Leg 3 is the same as that for Leg 1 except that the 32 sample bags of nodules have been lost. Also the two 5-foot long sections of piston core were consumed during analysis as described under the results section of this report.

All available original bottom photographic negatives are on deposit with EDS as part of the permanent microfilm record.

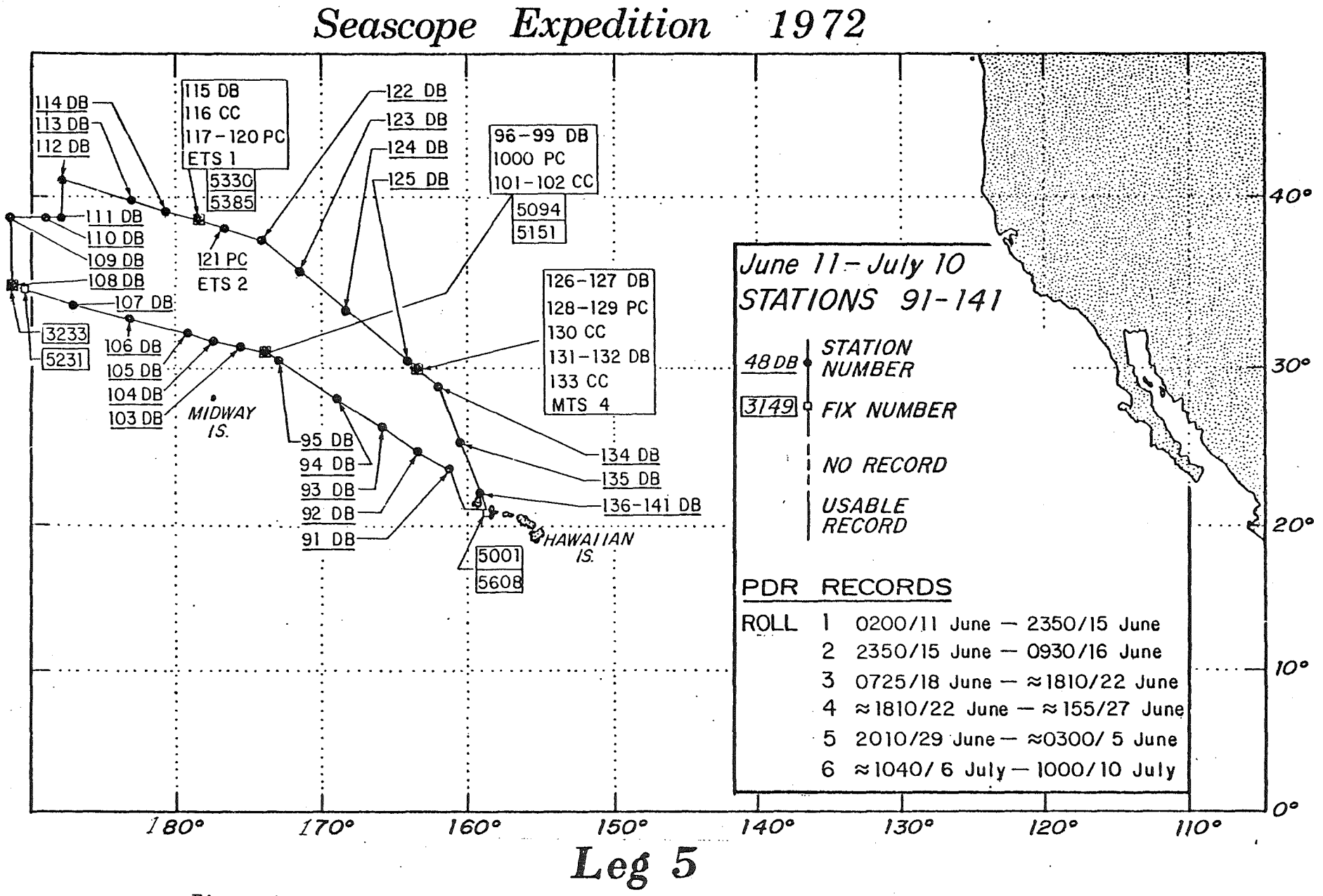

Seascope Expedition 1972
114 DB
113 DB
112 DB
111 DB
110 DB
109 DB
108 DB
107 DB
106 DB
105 DB
104 DB
103 DB
3233
5231
115 DB
116 CC
117 - 120 PC
ETS 1
5330
5385
121 PC
ETS 2
122 DB
123 DB
124 DB
125 DB
96 - 99 DB
1000 PC
101 - 102 CC
5094
5151
126 - 127 DB
128 - 129 PC
130 CC
131 - 132 DB
133 CC
MTS 4
MIDWAY IS.
95 DB
94 DB
93 DB
92 DB
91 DB
134 DB
135 DB
136 - 141 DB
HAWAIIAN IS.
5001
5608
June 11 - July 10
STATIONS 91 - 141
48 DB STATION NUMBER
3149 FIX NUMBER
NO RECORD
USABLE RECORD
PDR RECORDS
ROLL 1 0200/11 June — 2350/15 June
2 2350/15 June — 0930/16 June
3 0725/18 June — ≈1810/22 June
4 ≈1810/22 June — ≈155/27 June
5 2010/29 June — ≈0300/ 5 June
6 ≈1040/ 6 July — 1000/10 July
40°
30°
20°
10°
0°
180°
170°
160°
150°
140°
130°
120°
110°
Leg 5

Figure 4

LEG 5

The Sea Scope departed on Leg 5 from Honolulu, Hawaii on 10 June and returned on 10 July. Equipment performance was nearly flawless during the entire cruise. Figure 4 illustrates the locations of the sample stations, the test sites and the cruise track. The cruise chronology follows.

Leg 5 Chronology

Date (GM)	Time (GM)	Commence Activity
10 Jun	2205	Leave Honolulu
	2300	Sea trials off Honolulu
11 Jun	0315	Underway
	2240	Station 91DB
12 Jun	0240	Underway
	1820	Station 92DB
	2215	Underway
13 Jun	1112	Station 93DB
	1443	Underway
14 Jun	0715	Station 94DB
	1030	Underway
15 Jun	0320	Station 95DB
	0930	Underway
	1500	Begin MTS #3
	2020	Station 96DB
	2355	Continue MTS #3
16 Jun	0935	Station 97DB
	1340	Continue MTS #3
	1500	Station 98DB
	1830	Continue MTS #3
	2010	Station 99DB
	2310	Continue MTS #3

Date (GM)	Time (GM)	Commence Activity
17 Jun	0055	Station 100PC
	0455	Continue MTS #3
	0840	Station 101CC
	1750	Continue MTS #3
	2325	Station 102CC
18 Jun	0745	Conclude MTS #3 and Underway
	1540	Station 103DB
	1900	Underway
19 Jun	0320	Station 104DB
	0645	Underway
	1620	Station 105DB
	1930	Underway
20 Jun	1315	Station 106DB
	1700	Underway
21 Jun	1805	Station 107DB
	2145	Underway
22 Jun	1940	Station 108DB
	2355	Underway
24 Jun	0115	Station 109DB
	0520	Underway
	2240	Station 110DB
25 Jun	0245	Underway
	1340	Station 111DB
	1700	Underway
26 Jun	0045	Station 112DB
	0430	Underway
	1435	Station 113DB
	1745	Underway

Date (GM)	Time (GM)	Commence Activity
27 Jun	0400	Station 114DB
	0745	Underway
	1650	Survey Engineering Test Site #1 including Stations 115DB, 116CC, 117PC, 118PC, 119PC, 120PC
29 Jun	1940	Underway
30 Jun	0400	Survey Engineering Test Site #2 including Station 121PC
	2240	Underway
1 Jul	1225	Station 122DB
	1625	Underway
2 Jul	1150	Station 123DB
	1600	Underway
3 Jul	1355	Station 124DB
	1755	Underway
4 Jul	1305	Station 125DB
	1535	Underway
5 Jul	0315	Survey Mining Test Site #4 including Stations 126DB, 127DB, 128PC, 129PC, 130CC, 131DB, 132DB, 133CC
7 Jul	0235	Underway
8 Jul	0205	Station 134DB
	0520	Underway
	1805	Station 135DB
	2050	Underway
9 Jul	1630	Sampling Survey off Kauai Island including Stations 136DB, 137DB 138DB, 139DB, 140DB, 141DB
10 Jul	0720	Underway
	----	Arrive Honolulu

Objectives and Synopsis

The objectives of Leg 5 were the same as those of Legs 1 and 3. Interval samples were taken along the entire cruise track. Two "flat" nodule bearing areas were located during this leg.

Several future test sites were identified. Mining Test Site #3 is centered at 31°16'N, 174°02'W and has an area of approximately 40 nm^2 (5 nm x 8 nm) with a total relief of less than 10 fathoms. Nodules are rounded, very solid and 1/2 to 1-1/2 inches in diameter. Bottom photos show less than 25 percent nodule cover.

Mining Test Site #4 is centered at 30°40'N, 164°23'W and has an area of approximately 15 nm^2 (3 nm x 5 nm) with a vertical relief of less than 15 fathoms (90 feet). Approximately 8 nm^2 has vertical relief of less than ten fathoms. Nodules are rounded and 1 to 2-1/2 inches in diameter. Bottom photos show less than 25 percent nodule cover.

These two regions were surveyed and cores taken to determine their sediments engineering properties.

Engineering Test Site #1 is centered at 38°56'N, 178°34'W. It is an area of approximately 40 nm^2 and contains several features including abyssal hill aprons, base moats and an abyssal hill (small seamount?). A successful core was taken on the low sloping apron. Cores with very little recovery were taken in the base moat and perhaps the side slope of the hill. A camera run and drag box station were also made in this area.

Engineering Test Site #2 is centered at 38°37'N, 177°22'W. The 25 nm^2 area is occupied by a steep slope with several terraces. A core on one of the terraces yielded only Mn-Fe indurated material.

Six drag box stations were made off the south and east coasts of Kauai in a region reported by the University of Hawaii to have shallow water manganese deposits.

Operations during Leg 5 went very well. No equipment failures were evident and virtually all desired samples were taken.

Operations Summary

The ship logged 4500 nautical miles during Leg 5. Between 11 June and 9 July, 51 stations were occupied; five of them were for camera lowerings, eight for piston coring, and thirty-eight for dredging.

The camera station results were:

SS72-101CC	Film failed to advance
SS72-102CC	15 good frames
SS72-116CC	Many good frames
SS72-130CC	Camera cable sheared
SS72-133CC	Many good frames

The piston coring results were:

SS72-100PC	21 feet of core
SS72-117PC	22 feet 11 inches of core
SS72-118PC	No core
SS72-119PC	No core
SS72-120PC	1 foot of core + nodules
SS72-121PC	No core
SS72-128PC	20 feet of core
SS72-129PC	13 feet 3 inches of core

The dredging results were satisfactory. The modified Type "E" drag box was used and nodules were recovered at 21 of the 38 dredging stations. The smallest successful recovery was 10 pounds, and the largest 1230 pounds; the average recovery was 513 pounds.

The area surveys yielded qualitative data only. No bathymetric charting of these proposed test sites was attempted because of poor navigational control.

Data and Samples Summary

The original PDR records with corresponding navigational data can be found on microfilm archives deposited with EDS as referred to for Leg 1. As usual, there are no usable records whenever ship speed exceeded 7 knots. Known gaps in the record include:

16 June to 18 June	0930 - 0725
27 June to 29 June	1550 - 2010
5 July to 6 July	0300 - 1040

Should other gaps be found in the archived records they are the result of post-cruise loss.

The cumulative sample inventory for Leg 5 is:

Nodules:	209 burlap bags, total weight 10,489 lbs
	37 sample bags, total weight 556 lbs
	30 vials nodule powder (analysis)
	30 vials nodule powder (reference)
Sediments	18 plastic bags
Cores	78 feet in core tubes
Organisms:	24 jars

Disposition of samples for Leg 5 is the same as that for Leg 1 and for Leg 3.

All available original bottom photography negatives are on deposit with EDS as part of the permanent microfilm record.

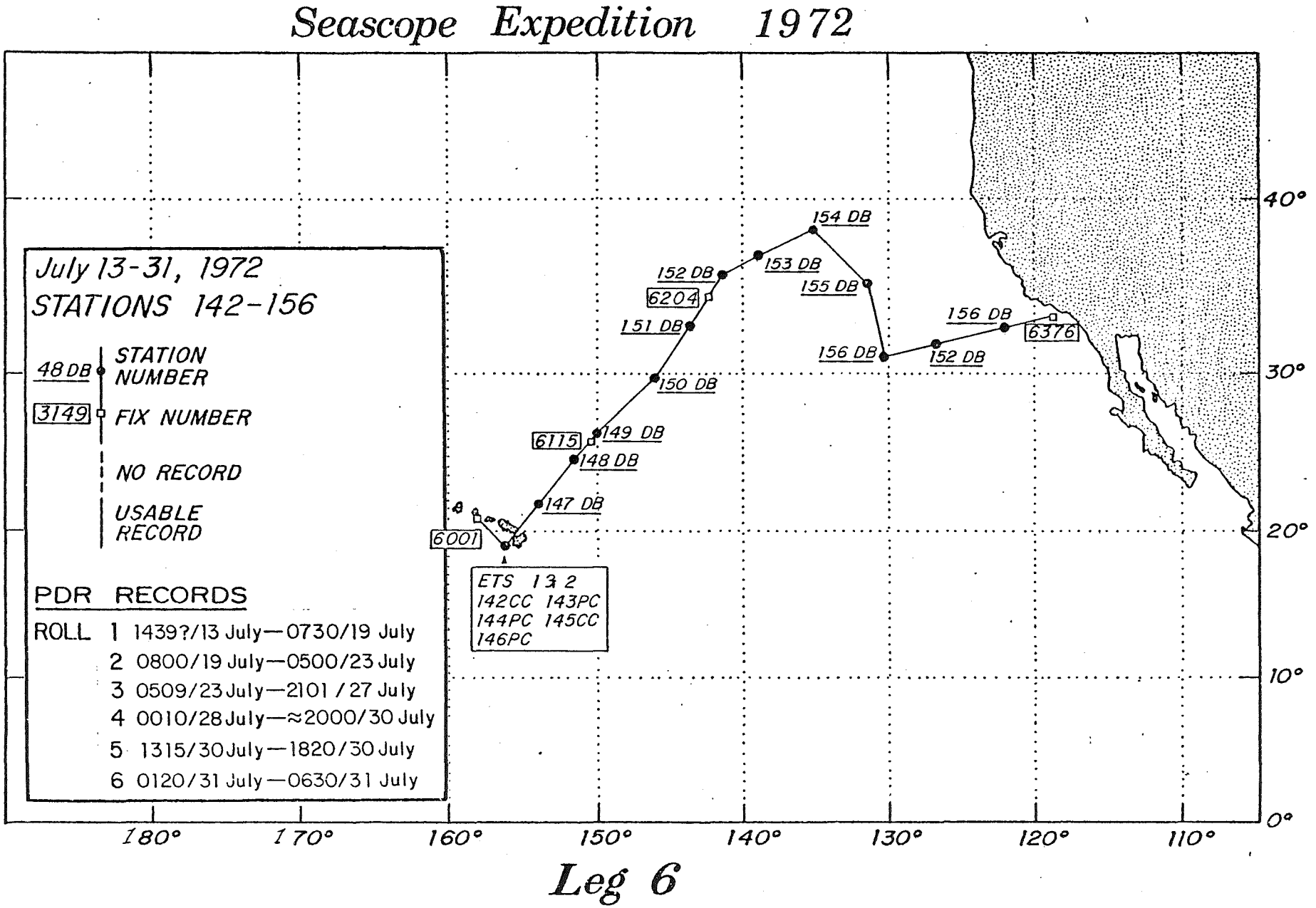

Seascope Expedition 1972
July 13-31, 1972
STATIONS 142-156
48 DB STATION NUMBER
3149 FIX NUMBER
NO RECORD
USABLE RECORD
PDR RECORDS
ROLL 1 1439?/13 July—0730/19 July
2 0800/19 July—0500/23 July
3 0509/23 July—2101 / 27 July
4 0010/28 July—≈2000/30 July
5 1315/30 July—1820/30 July
6 0120/31 July—0630/31 July
154 DB
153 DB
152 DB
6204
155 DB
151 DB
156 DB
6376
156 DB
152 DB
150 DB
6115
149 DB
148 DB
147 DB
6001
ETS 132
142CC 143PC
144PC 145CC
146PC
40°
30°
20°
10°
0°
180°
170°
160°
150°
140°
130°
120°
110°
Leg 6

Figure 5

LEG 6

Leg 6 occurred between 13 and 31 July departing from Honolulu. Two equipment test sites were surveyed west of Hawaii prior to beginning the track which went northeast to the Mainland. Engine and evaporator problems resulting in only regular interval sampling being done along the track until reaching the Southern California Boarderland. Two more equipment test sites were surveyed around San Nicolas Island before entering port at San Pedro on 31 July 1972. A map of the cruise track is shown in Figure 5; a cruise chronology follows.

Leg 6 Chronology

Date (GM)	Time (GM)	Commence Activity
13 Jul	1400	Leave Honolulu
14 Jul	0415	Survey Equipment Test Site #1: Station 142CC
	1200	Underway
	1900	Survey Equipment Test Site #2: Stations 143PC, 144PC, 145CC
15 Jul	1330	Underway
	1930	Survey Equipment Test Site #1: Station 146PC
	2200	Underway
16 Jul	2323	Station 147DB
17 Jul	0245	Underway
	2325	Station 148DB
18 Jul	0250	Underway
19 Jul	1234	Station 149DB
	1628	Underway
20 Jul	1938	Station 150DB
	2306	Underway
22 Jul	0625	Station 151DB
	1023	Underway
23 Jul	2317	Station 152DB

Date (GM)	Time (GM)	Commence Activity
24 Jul	0244	Underway
	2329	Station 153DB
25 Jul	0345	Underway
	1725	Station 154DB
	2041	Underway
26 Jul	1750	Station 155DB
	2111	Underway
27 Jul	2107	Station 156DB
28 Jul	0015	Underway
	0154	Station 157DB
	0500	Underway
29 Jul	2315	158DB
30 Jul	0255	Underway
	2015	Survey Equipment Test Site #3
	2200	Underway
	2315	Survey Equipment Test Site #4
31 Jul	0115	Underway
	----	Arrive San Pedro

Objectives and Synopsis

The objectives of Leg 6 were similar to Leg 5 but had to be altered somewhat because of engine and evaporator problems. Drag box samples were taken regularly at approximately 200 nm intervals along the track.

Four equipment test sites were surveyed as summarized briefly below:

#1 - Located west of Hawaii at approximately 19°45'N, 156°33'W, bottom virtually flat, depth 2550 fathoms (uncorrected), silty mud bottom, no rock or nodules.

#2 - Located west of Hawaii at approximately 18°56'N, 156°38'W, bottom virtually flat, depth 2500 fathoms (uncorrected), silty mud bottom, no rock or nodules.

#3 - Located northeast of San Nicolas Island at approximately 33°26'N, 119°20'W.

#4 - Located southeast of San Nicolas Island at approximately 33°08'N, 119°19'N.

Over-the-side operations during Leg 6 were all successful. No equipment failure occurred and all desired samples were taken.

Operations Summary

The ship logged 3700 nautical miles during Leg 6. Between 14 and 29 July 17 stations were occupied; two of them were for camera lowerings, three for piston coring, and twelve for dredging.

The camera station results were:

SS72-142CC	Many good frames
SS72-145CC	Many good frames

The piston coring results were:

SS72-143PC	No core
SS72-144PC	No core
SS72-146PC	No core

The dredging results were satisfactory yielding either nodules or rocks in all but the final attempt (158DB).

The area surveys yielded qualitative data only. No bathymetric charting of these proposed test sites was attempted because of poor navigational control.

Data and Samples Summary

The original PDR records with corresponding navigational data can be found in microfilm archives deposited with EDS as referred to for Leg 1. Again, there were no usable records whenever the ship speed exceeded 7 knots. Known gaps in the record are:

19 July	0730 - 0800
23 July	0500 - 0509
27 July to 28 July	2101 - 0010
30 July to 31 July	2000 - 0120

Should other gaps be found in the archived records they are the result of post-cruise loss.

The cumulative sample inventory for Leg 6 is:

Nodules:	16 burlap bags, total weight 745 lbs
	10 sample bags, total weight 83 lbs
	10 vials nodule powder (analysis)
	10 vials nodule powder (reference)
Sediments:	2 plastic bags

Disposition of samples for Leg 6 was the same as that for Leg 1.

All available original bottom photography negatives are on deposit with EDS as part of the permanent microfilm record.

SUMMARY

The overall cruise results are summarized in tabular form on the following several pages. The summary is in two parts. Table 1, Stations Summary, lists all pertinent station data such as time, position, water depth and material recovered. Table 2, Nodule Composition, lists the results of all nodule chemical analyses conducted in on-shore laboratories.

APPENDICES

The appendices to this report (Volumes II and III) provide additional detail as to field techniques, laboratory methods and station records. The material included in Volume II is:

Appendix A	Bathymetric Data
Appendix B	Comparative Evaluation of Drag Box Performance
Appendix C	Sediment Physical Properties
Appendix D	Physical Properties of Selected Nodules
Appendix E	Chemical Analysis of Nodules
Appendix F	Photographic Interpretation of Nodule Abundance

The material included in Volume III is:

Appendix G	Detailed Station Records.

Table 1 Stations Summary

SAMPLE NO SS72	DATE (1972)	LEG	TIME (Z)		LOCATION		DEPTH UNCORR (m)	MATERIAL RECOVERED	SAMPLES (Wt. in Wet lbs.)				
			In Water	On Deck	Lat.	Long.			Sample Bags	Burlap Bags	Sed. Samp.	Biol Samp.	Bottom Photos
1CC	10 Feb	1	0008	0420	16°55.9'N	113°04.4'W	3440	Mn Fragment					Yes
2DB	11 Feb	1	0407	0739	14°58.2'N	116°13.7'W	3980	Mn Nodules with Traces of Red Clay	1 (17)	4 (182)			
3DB	11 Feb	1	1528	1900	14°26.33'N	117°09.14'W	4072	Mn Nodules with Brown Clay	1 (22)	4 (197)		1	
4DB	12 Feb	1	0739	1256	14°12.4'N	118°52.5'W	3980	Mn Nodules	1(18)	3 (150)			
5DB	13 Feb	1	0125	0508	13°54.3'N	120°48.8'W	4255	Nodules, Brown Clay, Ash, Pumice	1 (11)	4 (205)			
6DB	13 Feb	1	1417	1721	13°40.43'N	122°18.4'W	4255	Nodules, Sediment, Pumice,Ash, Organisms.	1 (23)	12 (580)	1	1	
7DB	14 Feb	1	0118	0633	14°14.75'N	123°42.15'W	4438	Nodules, Sediment, Ash	1 (14)	6 (300)	1		
8CC	14 Feb	1	1905	2230	15°06.02'N	125°09.98'W	4392	Mn - Coated Fragments	1 (1-)				Some
9DB	15 Feb	1	0040	0452	15°07.9'N	125°07.9'W	4301	Nodules, Slabs, Volcanic Rx. Sediments, Organisms	1 (20)	13 (650)	1	1	
10DB	15 Feb	1	0520	0945	15°09.0'N	125°08.5'W	4392	Nodules, Volc. Ash, Sediment	1 (20)	4 (200)	1		
11DB	15 Feb	1	0954	1530	15°16.69'N	125°09.35'W	4346	None					
12DB	15 Feb	1	1745	2225	15°08.91'N	125°09.68'W	4002	Nodules, Sediment, Ash, Basalt	1 (20)	6 (300)	1		

Table 2 Stations Summary (Continued)

SAMPLE NO SS72	DATE (1972)	LEG	TIME (Z)		LOCATION		DEPTH UNCORR. (m)	MATERIAL RECOVERED	SAMPLES (Wt. in Wet lbs.)				
			In Water	On Deck	Lat.	Long.			Sample Bags	Burlap Bags	Sed. Samp.	Biol Samp.	Bottom Photos
13DB	16 Feb	1	0020	0415	15°02.6'N	125°08.3'W	4302	Nodules	1 (15)	4 (180)			
14DB	16 Feb	1	1310	1623	14°54.5'N	126°37.3'W	4484	None					
15DB	16 Feb	1	2145	0130	14°02.1'N	126°39.8'W	4438	None					
16DB	17 Feb	1	0704	1148	13°15.4'N	126°48.02'W	4758	Nodules, Sediment, Pumice Organisms	1 (20)	3 (150)	1	2	
17DB	17 Feb	1	2258	0430	13°08.46'N	128°36.06'W	4712	Nodules, Sediment,Organisms	1 (15)	6 (300)	1	1	
18DB	18 Feb	1	1535	2000	13°11.7'N	130°17.4'W	4758	Nodules, Organisms	1 (—)			1	
19SC	2 Apr	2	1628	1937	20°56.83'N	113°57.7'W	3660	Spade Core with Surface Nodules					Yes
20DB	2 Apr	2	2110	0030	20°55.77'N	113°57.15'W	3569	Nodules, Some Clay	1 (18)	3 (150)			
21DB	3 Apr	2	0110	0527	20°54.5'N	113°57.5'W	3614	Nodules, Brown Clay	1 (15)	2 (100)	1		
22DB	3 Apr	2	0700	1148	20°57.25'N	113°57.5'W	3660	Nodules, Sediment	1 (18)	2 (100)	1		
23DB	3 Apr	2	1240	1715	20°56.6'N	113°55.9'W	3569	Nodules, Brown Mud	1 (13)	2 (77)	1		
24DB	3 Apr	2	1810	2200	20°52.94'N	113°58.07'W	3660	Nodules, Organisms	1 (16)			1	

Table 1 Stations Summary (Continued)

SAMPLE NO SS72	DATE (1972)	LEG	TIME (Z)		LOCATION		DEPTH UNCORR (m)	MATERIAL RECOVERED	SAMPLES (Wt. in Wet lbs.)				
			In Water	On Deck	Lat.	Long.			Sample Bags	Burlap Bags	Sed. Samp	Biol Samp.	Bottom Photos
25DB	4 Apr	2	0100	0340	20°57.12'N	113°59.31'W	3660	Nodules	1 (22)	2 (100)			
26DB	4 Apr	2	0556	1120	20°56.09'N	113°58.29'W	3660	Nodules	1 (20)	1 (50)			
27DB	4 Apr	2	1606	2100	20°56.28'N	113°58.29'W	3660	Nodules, Sediment	1 (22)	5 (233)	1		
28DB	4 Apr	2	2130	0055	20°57.50'N	113°59.32'W	1982	Nodules, Sediment	1 (20)	8 (370)	1		
29DB	5 Apr	2	0138	0518	20°58.33'N	113°59.50'W	3642	Nodules, Sediment	1 (20)	5 (250)	1		
30DB	5 Apr	2	0630	1005	20°54.77'N	113°58.24'W	3656	Nodules, Sediment	1 (15)	8 (400)	1		
31DB	5 Apr	2	1130	1500	20°57.76'N	113°56.03'W	3861	Nodules, Rock	1 (15)	10 (500)			
32DB	5 Apr	2	1540	1947	20°55.01'N	113°55.92'W	3697	Nodules, Basalt	1 (15)	7 (350)			
33DB	5 Apr	2	2048	0015	20°57.02'N	113°57.58'W	3687	Nodules, Sediment	1 (20)	1 (50)	1		
34SC	6 Apr	2	0918	1230	19°47.57'N	115°09.55'W	3715	Spade Core with surface samples (nodules)					
35SC	11 Apr	2	1516	1754	19°40.1'N	115°15.7'W	3788	Spade Core, No Nodules					
36DB	11 Apr	2	1854	2255	19°36.5'N	115°18.27'W	3770	Nodules, Sediment, Basalt Organisms (Not Sampled)	1 (20)	3 (150)			

Table 1 Stations Summary (Continued)

SAMPLE NO SS72	DATE (1972)	LEG	TIME (Z)		LOCATION		DEPTH UNCORR. (m)	MATERIAL RECOVERED	SAMPLES (Wt. in Wet lbs.)				
			In Water	On Deck	Lat.	Long.			Sample Bags	Burlap Bags	Sed. Samp.	Biol Samp.	Bottom Photos
37CC	12 Apr	2	2356	0422	19°39.8'N	115°18.3'W	3770	Nodules					Yes
38CC	12 Apr	2	0618	1133	19°41.66'N	115°19.72'W	3770	Nodules					Yes
39SC	13 Apr	2	0355	0615	17°15.36'N	117°43.26'W	3788	Spade core with Surface Samples					
40SC	14 Apr	2	0008	0315	14°50.09'N	120°08.46'W	4081	No Sample					
41DB	14 Apr	2	2010	0015	12°31.81'N	122°27.5'W	4484	Nodules, Organisms Basalt; Bone	1 (20)	24 (1200)			
42DB	30 Apr	3	0014	0440	19°53.37'N	159°01.92'W	4301	Assorted Debris, Organisms Pumice					
43DB	30 Apr-1 May	3	2256	0230	19°53.23'N	163°04.79'W	5104	None					
44DB	1 May	3	1857	2240	19°58.74'N	166°04.99'W	4941	Mn Crusts, Basalt		1 (20)			
45DB	3 May	3	1550	1900	16°49.4'N	168°58.3'W	4903	None					
46DB	4 May	3	1800	2155	13°44.2'N	169°00.5'W	5904	None					
47DB	5 May	3	0830	1130	10°17.0'N	169°19.5'W	4795	None					
48DB	7 May	3	1800	2130	6°29.4'N	167°54.3'W	5126	None					

Table 1 Stations Summary (Continued)

SAMPLE NO SS72	DATE (1972)	LEG	TIME (Z)		LOCATION		DEPTH UNCORR. (m)	MATERIAL RECOVERED	SAMPLES (Wt. in Wet lbs.)				
			In Water	On Deck	Lat.	Long.			Sample Bags	Burlap Bags	Sed. Samp.	Biol Samp.	Bottom Photos
49CC	8 May	3	0318	0845	6°44.5'N	167°25.9'W	4703	None					
50DB	8 May	3	1145	1555	6°50.6'N	166°53.4'W	4703	Nodules	1 (10)	5 (235)			
51DB	8 May	3	2031	0036	6°51.4'N	166°51.5'W	4762	Nodules and Sediment	1 (15)	6 (300)	1	1	
52DB	9 May	3	0114	--	6°49.6'N	167°01.2'W	4683	Nodules	1 (12)	2 (70)			
53DB	9 May	3	0808	1232	6°47.0'N	166°53.0'W	4674	Nodules and Sediment	1 (12)	1 (20)	1		
54DB	10 May	3	0234	0730	7°11.3'N	164°52.1'W	4634	None					
55DB	10 May	3	1505	1938	7°09.3'N	163°42.4'W	4657	Rock: Pumice, no nodules	Jar(1)			1	
56CC	12 May	3	2032	0115	7°50.6'N	156°14.1'W	5528	Two Nodules					Possibly
57DB	13 May	3	0148	0534	7°48.0'N	156°19.0'W	5128	Nodules	1 (15)	4 (200)			
58DB	13 May	3	1700	2112	7°49.8'N	154°49.3'W	4908	Nodules	1 (10)	1 (40)			
59DB	14 May	3	0520	0910	8°05.7'N	153°54.9'W	5003	Nodules	1 (5)	--			
60DB	14 May	3	2115	0138	8°05.9'N	152°36.2W	5036	Nodules	1 (12)	6 (300)			

Table 1 Stations Summary (Continued)

SAMPLE NO SS72	DATE (1972)	LEG	TIME (Z)		LOCATION		DEPTH UNCORR (m)	MATERIAL RECOVERED	SAMPLES (Wt. in Wet lbs.)				
			In Water	On Deck	Lat.	Long.			Sample Bags	Burlap Bags	Sed. Samp.	Biol Samp.	Bottom Photos
61DB	15 May	3	0200	0618	7°56.7'N	152°48.3'W	5036	Nodules	1 (15)	2 (80)			
62CC	15 May	3	1939	0012	8°18.5'N	151°01.4'W	4903	None					None
63DB	16 May	3	0300	0702	8°16.4'N	150°59.6'W	4833	Nodules	1 (20)	5 (250)			
64DB	16-17 May	3	2233	0310	8°32.5'N	148°55.9'W	4760	Nodules	1 (3)	--		1	
65DB	17 May	3	1330	1815	8°44.4'N	147°31.9'W	5126	Nodules	1 (12)	3 (130)			
66DB	17 May	3	1931	0102	8°43.6'N	147°35.4'W	5062	Nodules, Organisms	1 (15)	7 (350)		1	
67PC	18 May	3	0156	0226	8°37.7'N	147°42.6'W	5033	None					
68DB	18 May	3	0255	0852	8°34.5'N	147°46.7'W	5128	Nodules	1 (15)	12 (610)			
69DB	18 May	3	1837	0020	8°57.9'N	146°40.1'W	5104	Nodules, Clay, Pumice	1 (14)	18 (900)	1		
70DB	19 May	3	0850	1305	8°57.3'N	145°48.4'W	5033	Nodules	1 (15)	2 (100)			
71DB	19 May 20 May	3	2354	0330	9°02.1'N	145°00.0'W	5036	Nodules, Pumice	1 (10)	39 (1950)			
72DB	20 May	3	0406	0738	8°58.8'N	145°06.6'W	4943	Nodules, Sediment	1 (16)	27 (1350)	1	1	

Table 1 Stations Summary (Continued)

SAMPLE NO SS72	DATE (1972)	LEG	TIME (Z)		LOCATION		DEPTH UNCORR (m)	MATERIAL RECOVERED	SAMPLES (Wt. in Wet lbs.)				
			In Water	On Deck	Lat.	Long.			Sample Bags	Burlap Bags	Sed. Samp.	Biol Samp.	Bottom Photos
73DB	20 May	3	2108	0040	9°26.8'N	145°33.3'W	5036	Nodules	1 (10)	14 (700)			
74DB	21 May	3	0621	0955	9°39.4'N	146°19.9'W	5036	Nodules, Pumice	1 (10)	15 (750)			
75CC	21 May	3	1130	1215	9°31.0'N	146°34.4'W	(Test) 164	None (Camera Test)					Mid Water Test
76PC	21 May	3	1845	2235	10°06.5'N	147°22.8'W	5380	Buff Clay (Piston Core)					
77DB	21-22 May	3	2302	0236	10°04.1'N	147°29.1'W	5197	None					
78DB	22 May	3	0312	0655	9°58.7'N	147°42.4'W	5128	Nodules, Pumice	1 (10)	43 (2150)			
79DB	22 May	3	1706	2055	11°07.9'N	148°04.3'W	5128	Nodules	1 (15)	45 (2250)			
80DB	22-23 May	3	2245	0232	10°58.7'N	148°19.5'W	5124	Nodules and Volcanic Rx	1 (15)	7 (350)			
81DB	23 May	3	0404	0658	11°01.8'N	148°22.9'W	5124	Nodules	1 (15)	38 (1900)			
82CC	23 May	3	1023	1436	11°01.1'N	148°29.9'W	5139	None					No
83DB	23 May	3	2200	0230	11°01.1'N	148°29.9'W	5344	Nodules	1 (15)	31 (1550)			
84DB	24 May	3	0257	0700	11°56.0'N	146°26.9'W	5314	Nodules, Pumice, Bone	1 (10)	34 (1700)			

Table 1 Stations Summary (Continued)

SAMPLE NO SS72	DATE (1972)	LEG	TIME (Z)		LOCATION		DEPTH UNCORR. (m)	MATERIAL RECOVERED	SAMPLES (Wt. in Wet lbs.)				
			In Water	On Deck	Lat.	Long.			Sample Bags	Burlap Bags	Sed. Samp.	Biol Samp.	Bottom Photos
145CC	15 July	6	0910	1315	18°58.3'N	156°34.4'W	4575	Photos					Yes
146PC	15 July	6	1914	2020	19°47.4'N	156°33.46'W	4740	No Core, Silty Clay on Core Barrel					
147DB	16-17 July	6	2333	0245	22°58.3'N	154°17.4'W	4502	Mn Crust, pumice	1 (3)				
148DB	17-18 July	6	2325	0220	25°00.0'N	153°03.9'W	5162	Nodules, Shark Teeth	1 (10)	5 (225)			
149DB	19 July	6	1226	1510	27°34.3'N	150°34.3'W	5126	Nodules, Pumice Shark Teeth	1 (20)	2 (110)			
150DB	20 July	6	1938	2306	30°00.7'N	147°59.0'W	4763	Basalt Rock	1 (15)	1 (35)			
151DB	22 July	6	0625	1023	33°02.7'N	144°31.2'W	5380	Nodules	1 (4)				
152DB	23-24 July	6	2317	0246	36°00.8'N	141°01.4'W	5197	Nodules	1 (10)	3 (120)			
153DB	24-25 July	6	2329	0345	37°31.2'N	138°30.3'W	5087	Nodules and Sed Sample	1 (15)	5 (250)	1		
154DB	25 July	6	1725	2041	39°00.1'N	136°01.2'W	4758	Nodules	1 (12)	1 (40)			
155DB	26 July	6	1748	2111	36°01.4'N	132°54.4'W	5051	Nodules and Sediment	1 (12)	1 (40)	1		
156DB	27 July	6	2107	0000	32°59.1'N	130°06.3'W	4502	Nodules, Shark Teeth	1 (3)				

Table 1 Stations Summary (Continued)

SAMPLE NO SS72	DATE (1972)	LEG	TIME (Z)		LOCATION		DEPTH UNCORR. (m)	MATERIAL RECOVERED	SAMPLES (Wt. in Wet lbs.)				
			In Water	On Deck	Lat.	Long.			Sample Bags	Burlap Bags	Sed. Samp.	Biol Samp.	Bottom Photos
133CC	6 July	5	2230	0242	30°41.79'N	164°22.85'W	5554	Bottom Photos					Yes
134DB	8 July	5	0205	0520	27°32.03'N	161°09.4'W	4941	Nodules, Shark Teeth, Pumice, Organisms,Bone	1 (10)		1		
135DB	8 July	5	1805	2130	25°15.45'N	160°18.19'W	4793	Basalt, Clay, Shark Teeth	1 (3)		1		
136DB	9 July	5	1630	1830	21°57.10'N	159°11.92'W	2489	None					
137DB	9 July	5	1935	2100	21°58.13'N	159°16.81'W	824	Volcanic and Coral Debris Sediment	1 (20)		1		
138DB	9 July	5	2220	2350	21°50.8'N	159°22.25'W	900	Sand, Mn Crust, Coral, Shells	1 (15)				
139DB	10 July	5	0035	0225	21°49.5'N	159°29.3'W	1371	Coral, Basalt, Sediment	1 (15)		1		
140DB	10 July	5	0330	0450	21°49.54'N	159°23.85'W	732	Shells, Volcanic Rock Coral Debris, Organisms		1 (10)		1	
141DB	10 July	5	0600	0720	21°52.59'N	159°19.18'W	641	Fe-Mn Encrusted Sandstone Volcanic Rocks, Coral		1 (15)			
142CC	14 July	6	0758	1140	19°47.0'N	156°30.2'W	4557	None					Yes
143PC	14-15 July	6	2255	0116	19°01.31'N	156°38.96'W	4538	No Core					
144PC	15 July	6	0250	0750	18°54.7'N	156°35.5'W	4575	No Core					

Table 1 Stations Summary (Continued)

SAMPLE NO SS72	DATE (1972)	LEG	TIME (Z)		LOCATION		DEPTH UNCORR. (m)	MATERIAL RECOVERED	SAMPLES (Wt. in Wet lbs.)				
			In Water	On Deck	Lat.	Long.			Sample Bags	Burlap Bags	Sed. Samp.	Biol Samp.	Bottom Photos
121PC	30 June	5	1650	2240	38°40.57'W	177°23.44'W	6405	Mn Crust - No Core					
122DB	1 July	5	1225	1625	37°43.45'N	174°29.13'W	5503	Pillow Basalt - Mn Crust Pumice	1 (12)				
123DB	2 July	5	1136	1600	35°50.22'N	171°41.44'W	5754	Pumice, Organisms	1 (6)			1	
124DB	3 July	5	1355	1755	33°44.32'N	168°50.61'W	5627	Nodules, A few Shark Teeth	1 (15)	20 (1000)			
125DB	4 July	5	1305	1730	31°43.78'N	165°42.96'W	5600	Nodules, Shark teeth, Clay Organisms	1 (20)	25 (1230)			
126DB	5 July	5	0315	0715	30°40.01'N	164°18.89'W	5361	Nodules, Shark Teeth	1 (12)	11 (550)			
127DB	5 July	5	1245	1645	30°41.15'N	164°26.35'W	5563	Nodules, Organisms, Shark Teeth	1 (12)	12 (600)	1		
128PC	5 July	5	1840	2145	30°39.68'N	164°21.30'W	5490	Piston Core: Buff Clay One Surface Nodule					
129PC	5-6 July	5	2330	0230	30°37.49'N	164°21.93'W	5490	Piston Core: Buff Clay with Surface Nodules					
130CC	6 July	5	0340	0815	30°40.1'N	164°19.5'W	5574	No Photos					None
131DB	6 July	5	1050	1515	30°38.00'N	164°24.4'W	5490	Nodules, Shark Teeth, Sediment	1 (15)	12 (600)	1	1	
132DB	6 July	5	1615	2000	30°39.56'N	164°20.91'W	3047	Nodules, Shark Teeth, Sediment	1 (15)	8 (430)	1		

Table 1 Stations Summary (Continued)

SAMPLE NO SS72	DATE (1972)	LEG	TIME (Z)		LOCATION		DEPTH UNCORR (m)	MATERIAL RECOVERED	SAMPLES (Wt. in Wet lbs.)				
			In Water	On Deck	Lat.	Long.			Sample Bags	Burlap Bags	Sed. Samp.	Biol Samp.	Bottom Photos
109DB	24 June	5	0115	0520	39°00.0'N	168°02.5'E	5490	None					
110DB	24 June	5	2240	0245	39°00.73'N	172°09.5'E	5783	Pumice, Organisms	1 (6)			1	
111DB	25 June	5	1340	1700	40°18.0'N	173°45.9'E	4399	Volcanic Rocks, Organisms	1 (15)	1 (30)		1	
112DB	26 June	5	0045	0430	40°20.39'N	175°37.79'E	5307	Nodules, Pumice, Organisms	1 (20)	8 (440)		1	
113DB	26 June	5	1435	1745	39°50.4'N	117°40.5'E	3898	None Except Organisms				1	
114DB	27 June	5	0400	0745	39°20.8'N	179°43.6'E	5197	Nodules	1 (20)	10 (500)			
115DB	28 June	5	0300	0650	38°56.39'N	178°37.26'W	2449	Nodules, Pumice, Organisms	1 (12)	4 (176)		1	
116CC	28 June	5	0752	1500	38°55.18'N	178°32.61'W	5399	Bottom Photos					Yes
117PC	28 June	5	1616	2020	38°54.7'N	178°37.1'W	5362	Piston Core - Buff Clay					
118PC	29 June	5	0015	0530	38°57.6'N	178°33.1'W	5472	No Core - Small Amount of Buff Clay					
119PC	29 June	5	1015	1400	38°56.4'N	178°32.7'W	5033	No Core - Mn Fragments in Core Barrel					
120PC	29 June	5	1545	1940	38°56.08'N	178°34.25'W	5472	One Foot Core; Buff Clay with Nodules					

Table 1 Stations Summary (Continued)

SAMPLE NO SS72	DATE (1972)	LEG	TIME (Z)		LOCATION		DEPTH UNCORR (m)	MATERIAL RECOVERED	SAMPLES (Wt. in Wet lbs.)				
			In Water	On Deck	Lat.	Long.			Sample Bags	Burlap Bags	Sed. Samp.	Biol Samp.	Bottom Photos
97DB	16 June	5	0935	1400	31°17.3'N	174°01.8'W	5362	Nodules, Ash, Organisms	1 (20)	7 (350)	-	1	
98DB	16 June	5	1500	1830	31°16.5'N	174°01.8'W	5362	Nodules, Mud, Organisms	1 (12)	12 (625)	-	1	
99DB	16 June	5	2010	2328	31°15.38'N	174°02.07'W	5033	Nodules, Pumice, Sediments	1 (15)	7 (350)	1	-	
100PC	17 June	5	0055	0455	31°17.2'N	174°03.2'W	5362	Piston Core: Buff Clay	-	-	-	-	
101CC	17 June	5	0840	1715	31°18.59'N	173°59.06'W	5801	None - No Photos					none
102CC	17-18 June	5	2318	0745	31°16.12'N	174°01.31'W	5344	Photos					Yes
103DB	18 June	5	1540	1900	31°39.5'N	175°35.7'W	5124	Nodules, Organisms, Pumice	1 (15)	21 (1050)		1	
104DB	19 June	5	0320	0645	31°58.4'N	177°19.55'W	5197	Nodules, Mn Crust, Pumice	1 (12)	6 (350)		1	
105DB	19 June	5	1620	1930	32°24.5'N	179°10.88'W	5380	Pumice, Tuff, Basalt Organisms	1 (9)	1 (21)		2	
106DB	20 June	5	1315	1850	33°07.9'N	177°04.6'E	5252	Nodules, Sediment, Basalt	1 (18)	6 (300)			
107DB	21 June	5	1805	2145	34°03.41'N	172°36.72'E	5161	Pumice, Organisms	1 (3)			1	
108DB	22 June	5	1940	2355	34°57.89'N	168°03.88'E	5508	Pumice	1 (15)			1	

Table 1 Stations Summary (Continued)

SAMPLE NO SS72	DATE (1972)	LEG	TIME (Z)		LOCATION		DEPTH UNCORR (m)	MATERIAL RECOVERED	SAMPLES (Wt. in Wet lbs.)				
			In Water	On Deck	Lat.	Long.			Sample Bags	Burlap Bags	Sed. Samp.	Biol Samp.	Bottom Photos
85DB	24 May	3	0946	1218	11°48.15'N	148°39.7'W	5503	Nodules	1 (5)	1 (20)			
86DB	24 May	3	1705	2130	12°01.4'N	149°18.0'W	5311	Nodules, Pumice, Sediment	1 (15)	12 (600)			
87DB	24-25 May	3	2230	0210	11°58.2'N	150°18.5'W	5003	Nodules, Pumice, Bone, Shells	1 (15)	--			
88DB	25 May	3	0700	1135	11°58.2'N	150°18.5'W	5003	Nodules, Sediment Bones, Pumice	1 (10)	5 (250)			
89DB	25 May	3	2100	0220	11°29.2'N	149°11.0'W	5303	Nodules, Brown Clay	1 (10)	6 (300)	1		
90DB	26 May	3	0720	1214	11°30.8'N	148°34.7'W	5128	Nodules, Pumice, Bone	1 (10)	1 (50)			
91DB	11 June	5	2240	0240	23°29.7'N	161°00.5'W	4579	None	--	--	--	--	--
92DB	12 June	5	1820	2215	25°03.7'N	163°38.8'W	4850	Nodules, Pumice, Bone Shark Teeth	2 (20)	--			
93DB	13 June	5	1112	1443	26°30.2'N	165°57.7'W	4396	Nodules, Basalt, Bone Shark Teeth Sediment	1 (11)	1 (22)	2	1	
94DB	14 June	5	0715	1030	28°23.8'N	169°03.0'W	4396	Nodules, Pumice, Basalt Sediment	1 (20)	16 (885)	1	1	
95DB	15 June	5	0320	0930	30°16.6'N	172°16.2'W	5362	Nodules, Sediment, Ash, Pumice	1 (20)	10 (500)	1	1	
96DB	15 June	5	2020	2355	31°19.82'N	174°01.29'W	5404	Nodules, Sediment Pumice Organisms	1 (20)	10 (500)	1	1	

Table 1 Stations Summary (Continued)

SAMPLE NO SS72	DATE (1972)	LEG	TIME (Z)		LOCATION		DEPTH UNCORR.	MATERIAL RECOVERED	SAMPLES (Wt. in Wet lbs.)				
			In Water	On Deck	Lat.	Long.			Sample Bags	Burlap Bags	Sed. Samp.	Biol Samp.	Bottom Photos
157DB	28 July	6	0154	0500	33°07.3'N	126°36.9'W	4302	Nodules, Pumice	1 (3)				
158DB	29-30 July	6	2315	0255	33°16.5'N	122°48.8'W	4209	None					

Table 2 Nodule Composition

SAMPLE NUMBER	MANGANESE		IRON		COBALT		NICKEL		COPPER		MOLYBDENUM	
	CHEM.	X-RAY	CHEM	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY
GRLD126	24.4	-	9.9	-	0.13	-	0.95	-	0.63	-	0.05	
1CC	8.4	8.3	6.2	6.3	0.01	0.01	0.15	0.17	0.20	0.22	0.04	0.03
2DB	29.6	29.7	6.0	6.0	0.10	0.10	1.38	1.28	1.16	1.12	0.08	0.06
3DBa	30.0	30.7	-	5.9	0.14	0.11	1.54	1.49	1.13	1.13	0.07	0.08
3DBb	30.2	30.0	-	6.2	0.10	0.13	1.46	1.47	1.22	1.24	0.06	0.08
3DBc	30.8	30.4	-	5.8	0.15	0.13	1.40	1.44	1.25	1.25	0.07	0.08
3DBd	28.8	29.6	6.9	6.5	0.11	1.13	1.48	1.45	1.12	1.17	0.07	0.08
3DBe	28.3	28.7	-	6.5	0.10	0.13	1.46	1.39	1.06	1.13	0.07	0.07
3DBf	27.4	27.6	-	6.6	0.13	0.12	1.28	1.26	1.00	1.00	0.06	0.07
3DBg	28.4	29.2	-	6.9	0.10	0.12	1.33	1.38	1.03	1.02	0.08	0.07
4DB	17.5	17.4	9.8	9.6	0.10	0.11	0.58	0.64	0.67	0.48	0.08	0.05
5DB	27.4	-	6.7	-	0.20	-	1.39	-	1.12	-	0.07	-
6DB	25.6	25.5	7.0	6.9	0.22	0.20	1.18	1.15	1.03	1.01	0.06	0.05
7DBa	29.7	29.3	-	6.3	0.20	0.18	1.45	1.41	1.17	1.14	0.06	0.07
7DBb	25.4	25.1	7.0	7.2	0.21	0.25	1.31	1.32	0.87	-	0.05	0.06
7DBc	24.2	23.9	-	6.7	0.20	0.21	1.15	1.30	0.92	0.96	0.06	0.05
7DBd	27.9	27.7	-	6.4	0.22	0.21	1.33	1.33	1.08	1.08	0.06	0.06
7DBe	27.9	28.0	-	6.3	0.17	0.20	1.28	1.31	1.05	1.06	0.06	0.06
7DBf	26.8	27.6	-	6.4	0.17	0.18	1.17	1.20	1.06	1.07	0.06	0.06
7DBg	26.8	27.1	-	6.5	0.17	0.17	0.96	1.22	0.98	1.01	0.06	0.06
8CC	29.7	30.2	6.7	6.9	0.25	0.23	1.33	1.41	1.02	1.06	0.06	0.07
9DBa	30.3	30.0		6.7	0.25	0.21	1.51	1.43	1.14	1.12	0.06	0.07
9DBb	29.7	29.7		6.8	0.18	0.21	1.47	1.48	1.00		0.07	0.07
9DBc	28.0	28.2	6.7	7.0	0.22	0.21	1.40	1.33	1.06	1.09	0.06	0.06
9DBd	29.4	29.5		6.8	0.17	0.21	1.22	1.40	1.16	1.15	0.07	0.06

Table 2 Nodule Composition (continued)

SAMPLE NUMBER	MANGANESE		IRON		COBALT		NICKEL		COPPER		MOLYBDENUM	
	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY
9DBe	28.3	28.3		7.5	0.19	0.22	1.37	1.34	1.00	1.01	0.06	0.06
9DBf	1.4	1.8	8.5	7.7	0.01	0.007	0.00	0.07	0.08	0.07	<0.01	0.01
10DB	30.9		6.7		0.27		1.45		1.08		0.06	
12DB	25.0	25.9	13.1	12.7	0.39	0.36	0.99	0.96	0.53	0.50	0.06	0.05
13DB	30.0	28.9	6.0	6.1	0.21	0.20	1.43	1.32	1.08	1.01	0.06	0.06
16DB-6	31.7		5.4		0.21		1.75		1.27		0.08	
16DB-7	31.5		4.6		0.16		1.69		1.40		0.08	
16DB-9	30.9		5.4		0.21		1.66		1.30		0.07	
16DB-15	30.9		5.7		0.19		1.80		1.29		0.08	
16DB-16	32.9		4.6		0.14		1.64		1.27		0.08	
16DB-19	28.7		6.6		0.28		1.59		1.26		0.08	
16DB-21	30.5		5.4		0.21		1.78		1.31		0.08	
16DB-22	27.4		5.4		0.19		1.52		1.12		0.07	
16DB-24	29.3		6.6		0.22		1.78		1.39		0.08	
16DB-25	30.5		5.4		0.19		1.75		1.39		0.08	
16DB-26	16.3		6.2		0.16		0.77		0.74		0.04	
16DB-27	29.7		5.8		0.17		1.59		1.29		0.07	
16DB	26.7	26.6	6.7	6.0	0.18	0.19	1.48	1.48	1.31	1.13	0.05	0.06
17DBa	30.7				0.24		1.65		1.14		0.07	
17DBb	28.1	27.2		6.6	0.32	0.37	1.46	1.37	1.16	1.14	0.05	0.06
17DBc	30.0	29.6		6.2	0.26	0.26	1.51	1.57	1.18	1.18	0.07	0.07
17DBd	30.8	30.4	5.8	6.0	0.28	0.26	1.48	1.55	1.22	1.21	0.07	0.06
17DBe	29.6	29.3		6.1	0.17	0.22	1.48	1.51	1.13	1.11	0.06	0.07
17DBf	26.8	26.2		7.3	0.37	0.33	1.28	1.30	1.02	1.02	0.05	0.05
17DBg	29.8	29.9	5.8	6.0	0.20	0.19	1.51	1.45	1.17	1.11	0.07	0.07

Table 2 Nodule Composition (continued)

SAMPLE NUMBER	MANGANESE		IRON		COBALT		NICKEL		COPPER		MOLYBDENUM	
	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY
17DBh	27.7	27.1		6.1	0.19	0.19	1.30	1.34	1.04	0.99	0.06	0.06
18DB	32.0	32.5	5.9	5.7	0.18	0.21	1.62	1.63	1.17	1.22	0.09	0.07
19SC	24.4	25.6	8.7	9.0	0.12	0.11	1.07	1.05	0.71	0.67	0.05	0.05
20DB	26.0	26.8	8.9	10.2	0.12	0.11	1.07	1.05	0.71	0.67	0.05	0.05
21DB	26.3	27.2	8.9	9.8	0.12	0.10	1.07	1.07	0.81	0.68	0.07	0.05
22DB	26.7	28.1	7.5	8.5	0.11	0.10	1.05	1.03	0.76	0.71	0.07	0.05
23DB	26.1	27.0	8.3	9.3	0.11	0.10	1.01	1.11	0.75	0.74	0.07	0.05
24DB	25.1	26.1	8.8	9.4	0.13	0.11	1.05	1.01	0.76	0.76	0.05	0.05
25DB	26.0	27.4	8.9	10.1	0.13	0.11	1.05	1.11	0.76	0.70	0.07	0.07
26DB	25.8	26.8	9.2	9.3	0.13	0.11	1.05	1.10	0.83	0.77	0.05	0.06
27DB	25.2	26.3	10.2	10.1	0.13	0.11	1.25	1.16	0.57	0.70	0.07	0.05
28DB	26.4	27.6	10.8	10.4	0.12	0.12	1.03	1.10	0.81	0.68	0.07	0.06
29DB	26.4	26.9	9.6	10.5	0.12	0.12	0.46	1.00	0.91	0.63	0.08	0.06
30DB	25.6	26.4	10.1	9.8	0.12	0.11	1.00	1.05	0.81	0.72	0.05	0.05
31DB	25.4	25.9	9.6	10.0	0.12	0.11	0.97	1.04	0.81	0.67	0.07	0.05
32DB	25.8	26.4	9.6	9.6	0.11	0.11	0.91	0.98	0.69	0.72	0.05	0.06
33DB	26.8	27.2	9.6	9.7	0.11	0.11	1.07	1.15	0.71	0.73	0.05	0.06
34SC	25.0	25.8	9.9	9.7	0.13	0.14	0.93	1.02	0.65	0.74	0.07	0.06
35SC	26.7	28.2	8.2	8.3	0.13	0.14	0.97	1.11	0.76	0.81	0.08	0.08
36DB	26.6	27.9	8.9	9.0	0.13	0.13	1.09	1.10	0.76	0.76	0.08	0.07
37CC	25.3	26.4	9.1	8.8	0.16	0.13	1.10	1.00	0.71	0.74	0.07	0.06
38DB	26.6	27.2	8.9	8.7	0.12	0.13	0.93	1.08	0.80	0.78	0.08	0.07
41DB	29.8	30.1	6.0	6.1	0.18	0.16	1.41	1.30	1.08	1.04	0.07	0.07
50DB		24.9		14.9		0.35		0.62		0.45		0.04
51DB	24.1	26.4	14.8	16.0	0.37	0.36	0.48	0.41	0.04	0.40	0.04	0.03

Table 2 Nodule Composition (continued)

SAMPLE NUMBER	MANGANESE		IRON		COBALT		NICKEL		COPPER		MOLYBDENUM	
	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY
52DB		24.7		14.6		0.33		0.62		0.43		0.03
53DB		26.3		11.8		0.29		0.93		0.63		0.03
57DB		23.0		8.8		0.20		0.90		0.89		0.03
58DB	26.8	28.6	6.5	7.2	0.19	0.16	1.36	1.31	1.22	1.33	0.05	0.04
59DB	26.5	28.1	5.6	6.1	0.16	0.14	1.37	1.41	1.27	1.38	0.05	0.04
59DB-2	28.6		6.1		0.14		1.82		1.50		0.05	
59DB-6	19.8		5.4		0.07		1.04		0.88		0.03	
59DB-10	28.8		4.1		0.12		1.72		1.55		0.05	
59DB-12	25.9		6.3		0.15		1.55		1.47		0.05	
59DB-16	27.8		5.9		0.15		1.68		1.50		0.05	
59DB-18	28.6		5.0		0.13		1.64		1.65		0.05	
59DB-25	27.8		5.9		0.14		1.62		1.68		0.05	
59DB-28	28.4		5.5		0.14		1.58		1.64		0.05	
59DB-29	27.4		6.2		0.16		1.55		1.44		0.06	
59DB-30	26.5		6.0		0.13		1.59		1.50		0.05	
60DB		19.5		8.7		0.19		0.78	0.59	0.58		0.03
61DB		27.1		7.9		0.15		1.28		1.19		0.04
61DB-9	30.5		5.6		0.18		1.68		1.52		0.06	
61DB-11	27.8		5.5		0.17		1.49		1.42		0.04	
61DB-14	29.7		5.5		0.16		1.53		1.50		0.05	
61DB-18	23.9		6.4		0.15		1.23		1.19		0.04	
61DB-24	30.5		5.6		0.18		1.62		1.55		0.05	
61DB-34	14.2		2.9		0.09		0.55		0.75		0.02	
63DB	28.3	30.3	6.3	7.2	0.20	0.19	1.45	1.50	1.17	1.25	0.06	0.05
64DB	27.5	29.7	5.1	6.1	0.19	0.17	1.40	1.39	1.17	1.25	0.05	0.04

Table 2 Nodule Composition (continued)

SAMPLE NUMBER	MANGANESE		IRON		COBALT		NICKEL		COPPER		MOLYBDENUM	
	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY
65DB		28.7		6.2		0.15		1.36		0.93		0.05
66DB		30.2		6.3		0.16		1.30		1.11		0.06
68DB	30.0	30.1	5.6	5.4	0.14	0.14	1.43	1.42	1.16	1.13	0.06	0.05
69DB		30.8		6.1		0.16		1.33		1.16		0.05
70DB	28.3	30.5	5.1	5.7	0.16	0.15	1.58	1.60	1.12	1.17	0.06	0.05
70DB-2	21.9		6.2		0.18		1.17		0.92		0.06	
70DB-11	29.5		4.2		0.19		1.69		1.38		0.07	
70DB-12	27.0		4.4		0.13		1.52		1.34		0.04	
70DB-13	29.5		4.5		0.18		1.72		1.42		0.06	
70DB-18	26.9		4.1		0.18		1.52		1.26		0.05	
70DB-19	30.2		3.9		0.18		1.78		1.43		0.06	
70DB-20	31.6		3.8		0.17		1.74		1.34		0.07	
70DB-23	30.6		4.5		0.17		1.74		1.34		0.07	
70DB-27	29.6		4.0		0.16		1.55		1.53		0.06	
70DB-29	32.1		4.9		0.17		1.52		1.28		0.07	
70DB-32	31.7		4.0		0.14		1.69		1.42		0.07	
70DB-33	31.3		5.2		0.19		1.62		1.27		0.07	
70DB-36	32.3		4.3		0.15		1.66		1.43		0.07	
70DB-39	31.1		4.3		0.15		1.84		1.40		0.07	
70DB-46	32.1		4.5		0.15		1.53		1.29		0.07	
71DB		30.9		6.3		0.17		1.43		1.01		0.06
72DB		29.7		6.5		0.17		1.35		0.98		0.06
73DB		30.3		6.2		0.18		1.36		1.00		0.06
74DB		28.8		7.3		0.18		1.29		0.87		0.06
78DB	29.6	31.8	5.8	6.0	0.20	0.17	1.46	1.54	1.12	1.18	0.06	0.06

Table 2 Nodule Composition (continued)

SAMPLE NUMBER	MANGANESE		IRON		COBALT		NICKEL		COPPER		MOLYBDENUM	
	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY
79DB		30.1		7.1		0.21		1.31		0.97		0.05
80DB		27.2		6.5		0.18		1.20		0.88		0.04
81DB		25.0		6.3		0.19		1.48		1.12		0.05
83DB		30.2		6.2		0.18		1.37		1.11		0.05
84DB	27.5	31.6	6.7	6.7	0.21	0.21	1.14	1.33	1.03	1.04	0.06	0.04
85DB		28.7		6.1		0.19		1.38		1.20		0.06
86DB		29.8		6.6		0.22		1.32		1.05		0.03
87DB		28.9		6.2		0.19		1.32		1.14		0.05
88DB		21.8		7.7		0.20		1.04		0.77		0.03
89DB	15.7	14.9	6.8	6.3	0.18	0.14	0.52	0.66	0.40	0.44		0.02
90DB		26.0		7.3		0.16		1.10		0.92		0.04
92DBa	12.8	13.2	13.2	12.1	0.19	0.21	0.39	0.44	0.22	0.25	0.03	<0.01
92DBb	18.5	18.8	19.9	19.0	0.18	0.22	0.16	0.17	0.22	0.22	0.07	0.04
93DB		16.2		9.5		0.19		0.63		0.37		0.02
94DB	21.6	21.6	12.5	12.0	0.23	0.25	0.71	0.79	0.53	0.56	0.04	0.03
95DB		20.6		11.4		0.21		0.75		0.54		0.03
96DB		16.6		11.0		0.16		0.46		0.36		0.01
97DB		20.1		11.2		0.18		0.62		0.49		0.03
103DB		17.1		11.1		0.17		0.46		0.37		0.02
104DB		16.0		8.2		0.10		0.68		0.50		0.02
106DB		20.5		11.8		0.28		0.42		0.31		0.03
112DBa		18.0		8.1		0.11		0.50		0.46		0.01
112DBb		10.6		9.4		0.08		0.19		0.19		<0.01
112DBc		12.3*		8.6*		0.09*		0.25*		0.29*		0.02*
114DB		12.1		10.6		0.10		0.25		0.23		0.01

*Average of wet chemical and X-ray fluorescence analyses. All other values are by X-ray fluorescence.

Table 2 Nodule Composition (continued)

SAMPLE NUMBER	MANGANESE		IRON		COBALT		NICKEL		COPPER		MOLYBDENUM	
	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY	CHEM.	X-RAY
115DB		14.3		8.4		0.07		0.31		0.30		0.02
119PC		15.2		10.7		0.13		0.36		0.25		0.03
120PC		10.1		1.07		0.10		0.10		0.17		0.01
121PC		21.7		7.8		0.12		1.15		0.70		0.03
122DB		22.4		8.2		0.09		0.33		0.36		0.03
124DB		19.0		12.6		0.26		0.56		0.35		0.04
125DB		19.5		12.8		0.29		0.66		0.38		0.03
126DB		20.9		12.3		0.25		0.77		0.47		0.04
127DB		21.1		12.1		0.26		0.80		0.45		0.04
131DB		21.7		11.6		0.26		0.87		0.47		0.04
132DB		21.2		11.2		0.23		0.86		0.56		0.03
134DB		23.3		10.9		0.26		0.97		0.65		0.04
138DB		19.6*		20.2*		0.65*		0.14*		0.07*		0.04*
141DB		1.5*		14.9*		0.06*		<0.01*		0.02*		<0.01*

*Average of wet chemical and X-ray fluorescence analyses. All other values are by X-ray fluorescence.