

ARIADNE II
R/V Thomas Washington

February 16, 1982 - April 1, 1982
Papeete, Tahiti - Balboa, Panama

CRUISE REPORT: HEAT FLOW, PORE
WATER AND CORING STATIONS

INTRODUCTION:

Leg 2 of cruise ARIADNE on the R/V Thomas Washington was conducted during 16 February to 1 April, 1982. The cruise originated in Papeete, Tahiti and terminated in Balboa, Panama. The co-chief scientists were Margaret Leinen, Graduate School of Oceanography, University of Rhode Island and Peter Lonsdale, Scripps Institution of Oceanography, University of California - San Diego. The participants and their affiliations are listed in Table 1. Other principal investigators for the site survey contract who did not participate in the cruise are also listed in Table 1. The cruise track consisted of a generally east-west trackline from Tahiti to the crest of the East Pacific Rise, and a north-south trackline along the crest of the East Pacific Rise. A general chart showing the cruise track and site survey locations is shown in Figure 1. A list of the sites surveyed and their locations as well as the location and types of measurements and samples at each site are included in Table 2. Data for hydrocasts are included in Appendix I. Data for Harpoons are included in Appendix II. Data for Cores are included in Appendix III.

The general areas selected for surveying were chosen by the Hydrogeology Working Group and the Site Survey Panel on the basis of criteria for detecting ridge flank hydrothermal circulation established by the Hydrogeology Working Group and on the basis of the available trackline coverage in between 15° and 20°S. The sites chosen for surveying were at about 19°S where data from a Lamont cruise (Conrad 13) indicated fairly smooth topography and continuous sediment cover. The preliminary sites chosen are shown in Figure 1, labeled "1", "2", "3", and "4". The remaining preliminary sites were contingency sites if the surveys at 19°S showed that the area was unacceptable.

SITE I

The first area surveyed was located at approximately 18°48'S, 129°45'W. A limited SEABEAM survey of the area was carried out (Figure 2). Two Benthos transponders were deployed for relay navigation of heat flow harpoon and core samplers. Although it was planned that the transponders would be retrieved after the survey, the interrogation equipment malfunctioned and the transponders were left to be picked up by the Challenger. One hydrocast was done to obtain bottom water samples and to calibrate the pore water chemical analyses before working with actual pore water samples.

Heat Flow

Failure of the traction unit on the main dredge winch precluded use of the Lamont heat flow probe and the Scripps rock sonar after a single initial deployment. All subsequent heat flow measurements were done using the Scripps heat flow probe. The probe bent easily and a strategy of limited, widely spaced lowerings had to be adopted since the probe had to be straightened after 3-6 lowerings. This severely limited the number of heat flow determinations made in each of the survey areas. A total of four lowerings with 15 penetrations were made in Site I. Their locations are listed in Table 2A and their positions are plotted in Figure 3. Heat flow values are included in Anderson's monthly reports.

Pore Waters

Two pore water "harpoon" samplers, one from URI and one from Walla Walla College ("Barnes" probe) were used on the cruise. Both worked successfully after some modification. Two harpoon lowerings were made at Site I. The locations are listed in Table 2A, shown in Figure 3, and the preliminary pore water chemistry analyses are given in Appendix I and discussed in Bender's reports.

Cores

Due to the failure of the main winch piston cores could not be taken. All cores listed are gravity cores. One core, 187 cm long, was taken at Site I which consisted entirely of red clay with no calcium carbonate and little siliceous biogenic material. The core location shown is in Figure 2A.

SITE II

Site II is located at about 19°25'S, 119°50'W. The SEABEAM survey of the site is shown in Figure 4. Three transponders were deployed for relay navigation of sampling equipment. One "Blue 1" was moved midway through the survey to position "Blue 2" to provide a better baseline for navigation in the eastern part of the survey area. Transponders "Blue 2" and "Green" were left in the area for Challenger navigation.

Heat Flow

Eleven heat flow lowerings with 37 penetrations were made at Site II. In addition, two gravity cores were equipped with thermistors and telemetering pingers for heat flow, only one of which was successful. Positions for the heat flow penetrations are listed in Table 2B and shown on Figure 5. Heat flow data are included in Anderson's report.

Pore Waters

Seven harpoon stations were run at Site II, three with the Barnes harpoon and four with the URI harpoon. Two of the URI harpoon stations, HARPOONS 5 and 6, failed. The pore waters recovered were analyzed for Cl^- , SiO_2 , NO_3^{-2} , PO_4^{-3} , Ca^{+2} , F^- on board. Additional analyses were made on some harpoon samples: Harpoon 3 was also analyzed for T_{alk} , refractive index and dissolved oxygen and was sampled for trace metals. Harpoon 4 was analyzed for refractive index. Harpoon 7 was analyzed for T_{alk} , Mg^{++} and was sampled for trace metals. Harpoon 8 was analyzed for O_2 and sampled for trace metals. Harpoon 9 was analyzed for T_{alk} and sampled for trace metals. Data for shipboard analyses are listed in Appendix I.

Cores

Five gravity cores were attempted. The first two were done using 4" diameter PVC liner without core barrels and were equipped for heat flow measurements. The sediment was too stiff for good penetration and the liner cracked both times.

Gravity core 2 (GC2) recovered 116 cm of calcareous core and clay. GC3 had no recovery.

We modified the gravity corer to use a Scripps piston core barrel and liner for better penetration and all subsequent cores were taken with this arrangement. GC2, 116 cm, was sampled at 2 cm intervals for CaCO_3 analysis and at 10 cm intervals for bulk density water content and thermal conductivity. GC5, (74 cm) and GC6 (165cm) were sampled at 2 cm intervals and analyzed for CaCO_3 onboard. GC4 (123 cm), GC5 and GC6 were also sampled at 10 cm intervals for bulk density, water content and thermal conductivity.

SITE III

Site III is located at about $18^{\circ}55'S$, $116^{\circ}53'W$. The SEABEAM survey of the site is shown in Figure 6. Three transponders were deployed for relay navigation of sampling equipment. One "Blue 1", was moved to improve navigation in the eastern part of the survey area. Transponders "Blue 2" and "Red" were left in the area for Challenger navigation.

Heat Flow

Seven heat flow lowerings with 40 penetrations were made at Site III. Their positions are listed in Table 2C and shown in Figure 7. Heat flow data are included in Anderson's report.

Pore Waters

Seven harpoon stations were run at Site III, three with the Barnes probe and four with the URI probe. Harpoon 12 did not penetrate sediments, the remainder recovered pore water. All harpoon samples were analyzed onboard for Cl^- , NO_3^- , PO_4^{3-} , SiO_2 , TaIk , Ca^{++} , and F^- . Additional analyses were done on some harpoons: Harpoon 10 was analyzed for Mn^{+2} and O_2 and sampled for trace metals. Harpoon 11, 13, 14 and 16 was sampled for trace elements. Harpoon 15 was sampled for inert gases.

Cores

Five gravity cores were taken at Site III. All were sampled at 10 cm intervals for calcium carbonate, water content, bulk density and thermal conductivity. In addition GC7 (303 cm) was sampled at 5 cm intervals for calcium carbonate content and GC8 (228 cm) was sampled at 2 cm intervals for calcium carbonate analysis onboard.

SITE IV

Site IV is located at about $19^{\circ}30'S$, $114^{\circ}57'W$. The SEABEAM survey of the site is shown in Figure 8. Three transponders were deployed for navigation of sampling instruments. None were left in the area.

Heat Flow

Nine heat flow lowerings with 43 penetrations were made at Site IV. Their positions are shown in Figure 9 and listed in Table 2D. The heat flow data are listed in Anderson's report.

Pore Waters

Six harpoon stations were completed at Site IV, two with the Barnes probe and four with the URI probe. All were successful. Pore waters were analyzed onboard for Cl^- , Ca^{++} , PO_4^{-3} , NO_2^{-2} , SiO_2 , and F^- . In addition all pore waters were sampled for trace elements. Harpoon 17 and 22 were also sampled for inert gases. Results of onboard analyses are included in Appendix 1.

Cores

Five gravity cores were taken at Site IV. All were sampled at 10 cm intervals for bulk density water content and thermal conductivity. Two of the cores, GC13 (124 cm) and GC16 (374 cm) were sampled at 2 cm intervals for CaCO_3 analysis onboard.

CALCIUM CARBONATE ANALYSES

Calcium carbonate was analyzed onboard to provide a stratigraphy (by correlation to oxygen isotopic stratigraphy) and to quantify the major biogenic diluent to the hydrothermal sediment. Since accurate weighings of samples cannot be made at sea, paired, equal volume samples were taken. One was dried and analyzed for carbonate in a pressure bomb. The other was sealed for determination of water content and dry weight on shore. Thus the carbonate contents in Appendix II are in relative pressure rather than percent and are uncorrected for water content variations. Nonetheless, the glacial-interglacial variation in calcium carbonate is obvious in the cores and could be used to constrain sampling for hydrothermal sediments.

Participants in ARIADNE LEG 2

1. Margaret Leinen	Co-chief Scientist	University of Rhode Island
2. Peter Lonsdale	Co-chief Scientist	Scripps Inst. of Oceanography
3. Michael Hobart	Marine Research	Lamont-Doherty Geological Observatory
4. Dallas Abbot	Graduate Student	Lamont-Doherty Geological Observatory
5. Hewitt Theyer	Research Aide	Lamont-Doherty Geological Observatory
6. Ross Barnes	Professor	Walla Walla College
7. David Graham	Research Specialist	University of Rhode Island
8. David Kahn	Research Specialist	University of Rhode Island
9. Andy Hutson	Graduate Student	University of Rhode Island
10. Tammy King	Marine Research Specialist	University of Rhode Island
11. Denzel Gleason	Development Technician	Scripps Inst. of Oceanography
12. Mary Linzer	Technician	Scripps Inst. of Oceanography
13. Lynn Abbott	Technical Services	Scripps Inst. of Oceanography
14. Frank Hubenka	Technical Services	Scripps Inst. of Oceanography
15. James Campbell	Technican	Scripps Inst. of Oceanography
16. Robert Wilson	Resident Technician	Scripps Inst. of Oceanography
17. Rodney Gilchrist	Resident Technician	Scripps Inst. of Oceanography

Principal Investigators not present on cruise

1. Michael Bender	Associate Professor	University of Rhode Island
2. Roger N. Anderson	Professor	Lamont-Doherty Geological Observatory
3. Fred Speiss	Professor	Scripps Inst. of Oceanography

TABLE 2A

SITE I LOCATIONS AND TYPES OF SAMPLES

STATION	DATE	LATITUDE	LONGITUDE	DEPTH	X	Y	SAMPLING	COMMENTS
Hydrocast 1	2/21/82	18°48.10	129°45.25	0.	2136.	1562.	12 Bottles	
Heat Flow 1 (HF) 1	2/21/82	18°48.11	129°46.82	0.	-634.	1547.		HF malfunction; retrieved without measurements
Harpoon 1 with Niskin	2/22/82	18°48.19	129°46.34	4140m	220.	1403.	19 samples & Niskin Cl ⁻ , NO ₃ ⁼ , H ₄ SiO ₂ , PO ₄ ⁼ , Ca ⁺⁺ , F ⁻ , °Brix	
Gravity Core (GC) 1	2/22/82	18°48.60	129°44.86	4130m	2835.	639.	5cm interval for clay mineralogy & chemistry, 10cm interval for CaCO ₃ & water content	3 sections, red clay Sec I 36-121cm Sec II 10-26 Sec III 0-10cm
Heat Flow 2 (HF) 2	2/23/82	18°45.81	129°46.00	0.	825.	5800.		traction unit on main dredge winch failed, retrieved without measurements
Heat Flow 3 (HF) 3	2/23/82							
	3/1	18°49.43	129°45.26	0.	2123.	-893.		
	3/2	18°49.32	129°45.20	0.	2224.	-690.		
	3/3	18°49.25	129°45.20	0.	2235.	-550.		
	3/4	18°49.06	129°45.22	0.	2196.	-201.		
Heat Flow 4 (HF) 4	2/24/82							
	4/1	18°48.68	129°45.98	0.	863.	489.		
	4/2	18°48.57	129°45.99	0.	841.	709.		
	4/3	18°48.51	129°45.81	0.	1167.	804.		
	4/4	18°48.47	129°45.54	0.	1640.	884.		
	4/5	18°48.46	129°45.45	0.	1793.	904.		
	4/6	18°48.32	129°44.97	0.	2632.	1168.		
	4/7	18°48.20	129°44.62	0.	3245.	1381.		
	4/8	18°48.09	129°44.41	0.	3613.	1588.		
	4/9	18°47.98	129°44.26	0.	3877.	1782.		
Harpoon 2 with Niskin	2/24/82			4132.			20 samples & Niskin NO ₃ ⁼ , SiO ₂ , PO ₄ ⁼ , T _{alk} , Ca ⁺⁺ , F ⁻ , °Brix	URI probe leaked at adapters, sampled for trace elements

Green 4048
+ 90
4138

Red 4051
90
4141

40
3434

Blue 2

3343
90
3433

Green

3335
90
3425

Red

3396
90
3486

TABLE 10 SITE 111 LOCATION OF STATIONS AND SAMPLING LOG

STATION	DATE	LATITUDE	LONGITUDE	DEPTH	Δ	Σ	SAMPLING	COMMENTS
Harpoon 10	3/5/82	18°54.33	116°51.04	3425.	1690.	2671.	20 samples & Niskin Cl ⁻ , NO ₃ ⁻ , SiO ₂ , PO ₄ ³⁻ , T _{alk} , Ca ⁺⁺ , F ⁻ analyzed trace metals	Barnes Probe. Diagenetic Penetration between 189.8-200.0 cm
Heat Flow 18 (HF) 18	3/5/82							
	18/1	18°55.67	116°50.34	3408.*	2038.	1119.		
	18/2	18°55.67	116°50.47	3449.*	2590.	1118.		
	18/3	18°55.74	116°50.39	3378.*	2824.	994.		
	18/4	18°55.71	116°50.25	3343.*	3070.	1029.		
	18/5	18°55.70	116°50.14	3367.*	3262.	1055.		
Heat Flow 19 (HF) 19	3/5/82							
	19/1	18°55.07	116°52.86	3429.*	-1518.	2224.		
	19/2	18°55.12	116°52.51	3468.*	-903.	2137.		
	19/3	18°55.12	116°52.03	3466.*	-60.	2123.		
	19/4	18°55.09	116°51.48	3439.*	910.	2190.		
Harpoon 11	3/6/82	18°55.10	116°51.94	3432.	109.	2172.	20 samples & Niskin Cl ⁻ , NO ₃ ⁻ , SiO ₂ , PO ₄ ³⁻ , T _{alk} , Ca ⁺⁺ , F ⁻ analyzed trace metal samples taken	URI Probe 3 Sec. III 0-103cm I 103-203cm II 203-303cm
Gravity Core (GC) 7	3/6/82	18°55.68	116°50.56	3450.	2521.	1095.		sampled every 5cm for mineralogy, chemistry, carbonate sampled every 10cm for water content porosity, thermal conductivity
Heat Flow 20 (HF) 20	3/6/82							
	20/1	18°53.40	116°50.49	3403.*	2657.	5307.		
	20/2	18°53.43	116°50.14	3439.*	3271.	5255.		
	20/3	18°53.50	116°50.01	3408.*	3497.	5112.		
	20/4	18°53.79	116°50.00	3429.*	3508.	4592.		
	20/5	18°54.03	116°50.03	3408.*	3457.	4150.		
	20/6	18°54.16	116°50.13	3391.*	3281.	3898.		
	20/7	18°54.43	116°50.15	3423.*	3242.	3412.		
	20/8	18°54.64	116°50.12	3423.*	3290.	3021.		
	20/9	18°54.64	116°50.38	3393.*	3372.	3021.		
Gravity Core 8 (GC) 8	3/6/82	18°55.64	116°50.45	3350.	2715.	1180.		every 2cm for carbonate analyzed onboard. samples taken for chemistry & mineralogy every 2cm every 10cm for physical properties
Harpoon 12	3/6/82	18°55.60	116°50.32	3335.	2942.	1237.	20 samples & Niskin	URI Probe all samples are bottom water; probe did not penetrate
Heat Flow 21 (HF) 21	3/7/82							
	21/1	18°54.37	116°55.41	3552.*	-4994.	2515.		
	21/2	18°54.37	116°54.36	3582.*	-5022.	3506.		
	21/3	18°54.56	116°54.59	3533.*	-4944.	3158.		
	21/4	18°54.56	116°54.23	3493.*	-3909.	3160.		
	21/5	18°54.62	116°53.94	3449.*	-3401.	3062.		
	21/6	18°54.81	116°53.80	3439.*	-3165.	3077.		
Gravity Core 9 (GC) 9	3/7/82	18°55.11	116°51.74	3430.	462.	2151.		3 sec. III 0-112cm II 112-212c I 212-312c
Harpoon 13	3/7/82	18°55.73	116°50.36	3335.	2875.	1033.	20 samples & Niskin Cl ⁻ , NO ₃ ⁻ , SiO ₂ , PO ₄ ³⁻ , T _{alk} , Ca ⁺⁺ , F ⁻ analyzed trace metal samples taken	Barnes Probe with 20cm nylon coils penetration between 140 and 160cm
Heat Flow 22 (HF) 22	3/7/82							
	22/1	18°58.20	116°51.59	3393.*	536.	-2553.		
	22/2	18°58.60	116°51.75	3408.*	441.	-4293.		
	22/3	18°58.71	116°51.61	3420.*	685.	-4498.		
	22/4	18°58.78	116°51.45	3427.*	960.	-4621.		
	22/5	18°58.75	116°51.36	3398.*	1115.	-4559.		
Gravity Core 10 (GC) 10	3/7/82	18°58.65	116°51.35	3310.	1147.	-4279.		3 sec. III 0-123 II 123-223 I 223-323
Harpoon 14	3/7/82	18°55.72	116°50.19	3325.	3175.	1025.	20 samples & Niskin Cl ⁻ , NO ₃ ⁻ , SiO ₂ , PO ₄ ³⁻ , T _{alk} , Ca ⁺⁺ , F ⁻ analyzed trace metal samples taken	URI Probe
Heat Flow 23 (HF) 23	3/8/82							
	23/1	18°58.14	116°52.40	3429.	-712.	-3433.		
	23/2	18°58.32	116°52.13	0.	-227.	-3773.		
	23/3	18°58.42	116°52.03	0.	-58	-2958.		
	23/4	18°58.47	116°51.99	0.	17.	-4053.		
	23/5	18°58.55	116°51.91	0.	151	-4193.		
Heat Flow 24 (HF) 24	3/8/82							
	24/1	18°58.37	116°51.28	3383.	1269.	-4795.		
	24/2	18°58.92	116°51.24	3398.	1341.	-4876.		
	24/3	18°58.95	116°51.03	3328.	1610.	-4932.		
	24/4	18°58.96	116°50.94	3357.	1853.	-4948.		
	24/5	18°59.01	116°50.35	3321.	2009.	-5052.		
	24/6	18°59.06	116°50.62	0.	2427.	-5141.		
Harpoon 15	3/8/82	18°55.71	116°50.32	3335.	2945.	1044.	20 samples & Niskin	Barnes Probe. inert gases; penetration between 140 & 160cm
Gravity Core 11 (GC) 11	3/8/82	18°55.69	116°50.47	3370.	2684.	1088.	10 samples for water content, physical properties	3 sec. III 0-111cm II 111-211cm I 211-311cm
Harpoon 16	3/8/82	18°54.11	116°55.06	2550.	-5370.	2999.		URI Probe. penetration uncertain between #5 & #9?

TABLE 22 SITE 11 LOCATION OF STATIONS AND SAMPLING LOG

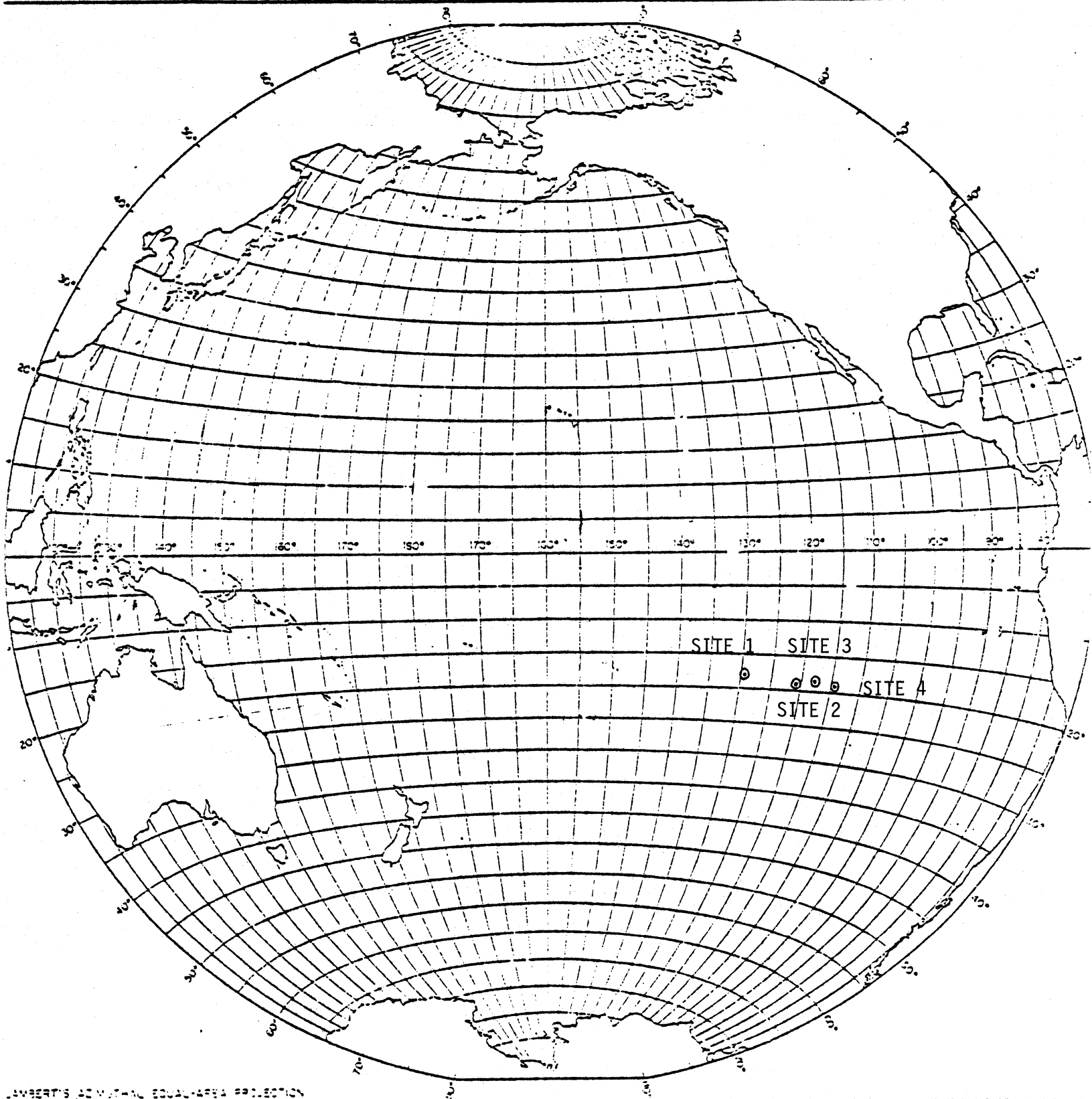
STATION	DATE	LATITUDE	LONGITUDE	DEPTH	U	V	SAMPLING	COMMENTS
Harpoon 17	3/10/82	19°29.775	114°57.64W	1435m	-153.	423.	Cl ⁻ , NO ₃ ⁻ , PO ₄ ⁻³ , SiO ₂ , Ca ⁺⁺ , F ⁻ , inert gases & trace metals	Sarnes Probe Inertest SiO ₂ & Ca ⁺⁺ or F ⁻ Probe nit Land Object
Heat Flow 25 (HF) 25	3/10/82							
	25/1	19°29.01	114°57.11	3350.*	587.	1828.		
	25/2	19°29.07	114°56.93	0.	1001.	1712.		
	25/3	19°29.12	114°56.66	0.	1465.	1625.		
Heat Flow 26 (HF) 26	3/10/82							
	26/1	19°29.40	114°57.71	3335.*	-368.	1116.		
	26/2	19°29.41	114°57.64	3361.*	-544.	1082.		
	26/3	19°29.47	114°57.46	3357.*	58.	979.		
	26/4	19°29.60	114°57.29	0.	155.	729.		
	26/5	19°29.62	114°57.26	3280.*	413.	597.		
	26/6	19°29.60	114°57.22	0.	490.	743.		
Gravity Core 12 (GC) 12	3/10/82	19°29.65	114°57.22	3280.	480.	537.	10cm interval for bulk density, water content, thermal conductivity	Sec. I 0-91cm
Harpoon 18	3/10/82	19°29.56	114°57.30	3382.	349.	806.	Cl ⁻ , NO ₃ ⁻ , PO ₄ ⁻³ , SiO ₂ , Ca ⁺⁺ , F ⁻ , trace metals	URI Probe penetration between ports #5 & 6
Gravity Core 13 (GC) 13	3/11/82	19°29.77	114°57.64	3435.	-247.	433.	2cm intervals for CaCO ₃ , 10cm intervals for bulk density, water content, thermal conductivity	Sec. I 0-124cm
Gravity Core 14 (GC) 14	3/11/82	19°29.85	114°56.62	3390.	1537.	278.	10cm intervals for bulk density, water content, thermal conductivity	Sec. III 0-100cm Sec. II 100-200cm Sec. I 200-281cm
Harpoon 19	3/11/82	19°29.80	114°56.55	3390.	1664.	361.	Cl ⁻ , NO ₃ ⁻ , PO ₄ ⁻³ , SiO ₂ , Ca ⁺⁺ , F ⁻ , sampled for trace elements	URI Probe
Gravity Core 15 (GC) 15	3/11/82	19°29.68	114°58.91	3300.	-2469.	589.	10cm intervals for water content, bulk density, thermal conductivity	Sec. III 200-324cm Sec. II 100-200 Sec. I 0-100
Heat Flow 27 (HF) 27	3/11/82							
	27/1	19°29.64	114°58.90	0.	-2454.	658.		
	27/2	19°29.79	114°58.94	0.	-2522.	394.		
	27/3	19°30.00	114°58.96	0.	-2552.	-1.		
	27/4	19°30.26	114°58.95	0.	-2546.	-486.		
	27/5	19°30.51	114°58.91	0.	-2471.	-946.		
Heat Flow 28 (HF) 28	3/11/82							
	28/1	19°29.78	114°58.52	0.	-1796.	398.		
	28/2	19°29.77	114°58.43	0.	-1623.	431.		
	28/3	19°29.76	114°58.14	0.	-1121.	435.		
	28/4	19°29.80	114°57.90	0.	-700.	367.		
	28/5	19°29.82	114°57.73	0.	-431.	329.		
	28/6	19°29.72	114°57.59	0.	-162.	521.		
Harpoon 20	3/12/82	19°29.74	114°58.14	3410.	-1129.	474.	Cl ⁻ , PO ₄ ⁻³ , SiO ₂ , NO ₃ ⁻ , Ca ⁺⁺ , F ⁻ , sampled for trace metals	URI Probe penetration to between ports #1 & 2
Heat Flow 29 (HF) 29	3/12/82							
	29/1	19°30.70	114°58.74	3320.*	-2175.	-1297.		
	29/2	19°30.76	114°58.54	3332.*	-1829.	-1411.		
	29/3	19°30.31	114°58.50	3329.*	-1747.	-1493.		
	29/4	19°30.76	114°58.44	3347.*	-1640.	-1410.		
	29/5	19°30.74	114°58.21	3355.*	-1246.	-1362.		
Heat Flow 30 (HF) 30	3/12/82							
	30/1	19°31.46	114°57.57	3257.*	-129.	-2699.		
	30/2	19°31.23	114°57.62	3315.*	-213.	-2270.		
	30/3	19°30.94	114°57.51	3280.*	-15.	-1741.		
Heat Flow 31 (HF) 31	3/12/82							
	31/1	19°30.68	114°57.93	3288.*	-769.	-1257.		
	31/2	19°30.51	114°57.96	3291.*	-627.	-934.		
	31/3	19°30.66	114°57.78	3285.*	-502.	-1219.		
	31/4	19°30.59	114°57.63	3315.*	-229.	-1097.		
	31/5	19°30.50	114°57.44	3290.*	101.	-927.		
	31/6	19°30.50	114°57.21	3308.*	497.	-920.		
Harpoon 21	3/12/82	19°29.78	114°57.65	3435.	-271.	412.	Cl ⁻ , NO ₃ ⁻ , PO ₄ ⁻³ , SiO ₂ , Ca ⁺⁺ , F ⁻ , sampled for trace elements	URI Probe penetration between ports #4 & 5
Gravity Core 16 (GC) 16	19°29.73	114°58.19	3300.	-1218.	499.	sampled at 2cm intervals for CaCO ₃ & ac	Sec. IV 300-374cm Sec. III 200-300 Sec. II 100-200 Sec. I 0-100	
Heat Flow 32 (HF) 32	3/13/82							
	32/1	19°29.73	114°57.75	0.	-437.	492.		
	32/2	19°29.76	114°57.71	0.	-376.	449.		
	32/3	19°29.74	114°57.55	0.	-270.	486.		
Heat Flow 33 (HF) 33	3/13/82							
	33/1	19°30.11	114°57.17	0.	561.	-208.		
	33/2	19°30.02	114°57.05	0.	785.	-33.		
Heat Flow 34 (HF) 34	3/13/82							
	34/1	19°30.12	114°56.75	0.	1317.	-215.		
	34/2	19°30.06	114°56.58	0.	1604.	-109.		
	34/3	19°30.01	114°56.40	0.	1918.	-17.		
	34/4	19°29.95	114°56.29	0.	2120.	90.		
Harpoon 22	3/13/82	19°29.73	114°58.46	3365.	-1684.	493.	Cl ⁻ , NO ₃ ⁻ , PO ₄ ⁻³ , SiO ₂ , Ca ⁺⁺ , F ⁻ , sampled for inert gases and trace metals	Sarnes Probe penetration between probes #8 & 9 on main probe, 105 & small probe - sampler tilted

D.M. = decimal
minute

CORE LOCATION

ARIA-2

			<u>D.M.</u>		<u>D.M.</u>
Site One					
Gravity Core	1	18°48'28" S	48.5	129°44'26" W	44.4
Site Two					
Gravity Core	2	19°25'57" S	26.0	119°49'09" W	49.2
"	4	19°24'36" S	24.6	119°48'03" W	48.1
"	5	19°24'27" S	24.5	119°52'50" W	52.8
"	6	19°23'28" S	23.5	119°48'19" W	48.3
Site Three					
Gravity Core	7	18°55'17" S	55.3	116°50'16" W	50.8
"	8	18°55'12" S	55.2	116°50'05" W	50.1
"	9	18°54'59" S	55.0	116°51'33" W	51.6
"	10	18°58'53" S	58.9	116°50'54" W	50.9
"	11	18°55'17" S	55.3	116°50'07" W	50.2
Site Four					
Gravity Core	12	19°29'16" S	29.3	114°57'10" W	57.2
"	13	19°29'36" S	29.6	114°57'15" W	57.3
"	14	19°29'45" S	29.8	114°56'02" W	56.0
"	15	19°29'28" S	29.5	114°59'11" W	59.2
"	16	19°29'33" S	29.6	114°58'39" W	58.7



SITE 1 SITE 3
 ● ● ● SITE 4
 SITE/2