Cruise Report
CONRAD 30-01

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Introduction

CONRAD 30-01 was a transit leg from Ponta Delgada, Azores to Bridgetown, Barbados carried out between 11 January 1989 and 28 January 1989. During this transit two short reconnaissance surveys were carried out on the Mid-Atlantic Ridge near the Kane fracture zone, an area known as the MARK area (Mid-Atlantic Ridge at Kane). One survey, funded by JOI/USSAC, was a 3-day multichannel seismic study of the MARK rift valley in the vicinity of ODP Sites 648, 649 and 670; the other was an NSF funded, 4-day Sea Beam and single channel seismic survey of several small sediment ponds near the ridge crest.

The objectives of the multichannel seismic survey were two-fold. First, to evaluate the feasibility of using multichannel seismics to image oceanic crustal structure at the Mid-Atlantic Ridge. Multichannel seismic techniques have been used quite successfully to study the crustal structure of the East Pacific Rise and the northern Juan de Fuca Ridge and to image old, sediment-covered oceanic crust at many locations throughout the world. It has not yet been demonstrated that these techniques can be used with similar success at slow spreading ridges where the sea floor topography is substantially rougher and is unsedimented. Secondly, we hoped to use the multichannel reflection data obtained in this survey to constrain the crustal structure across and along the MARK rift valley. Specific questions which were to be addressed included:

* Is there a crustal magma chamber associated with the Snake Pit hydrothermal area in the northern MARK rift valley (Site 649)?
* What is the along-strike segmentation of the MARK rift valley, and in particular, the nature of the discordant zone at 23°15'N near Site 670?
* Is there evidence for large, low-angle detachment faults in the crust in the MARK area, especially near the Kane transform (Site 669)?

The Sea Beam and single channel seismic surveys of the sediment ponds were conducted in preparation for a heat flow experiment planned for later this year by M. Langseth, R.P. von Herzen and K. Becker. This heat flow work is aimed at understanding the hydrogeology of these isolated sediment ponds and the role of porewater circulation through the underlying basement rocks in explaining the discrepancy between the observed and predicted heat flow in these basins. The surveys carried out on this leg mapped the detailed bathymetry and sediment thickness in and around three sediment ponds on crust of different age on the Mid-Atlantic Ridge near 23°N.

Cruise Narrative

R/V ROBERT D. CONRAD left Ponta Delgada, Azores at 0953L 11 January 1989 to begin CONRAD 30-01. A list of the members of the scientific party and crew on 30-01 is given in the Appendix. After leaving the harbor, the ship proceeded at full speed for the MARK area (23°55'N, 44°45'W). When the ship was beyond the 200 mile Azorian EEZ, at ~1300Z on 12 January, Sea Beam, magnetic, and gravity data acquisition began. The ship steered a course of 240° which paralleled three previous Sea Beam profiles obtained while transiting to and from the Azores on recent cruises by Purdy and Sempere (Figure 1). The course was changed at 2346Z on 13 January (~32°39.2N, 36°06.4W) to proceed directly to the MARK area, and we arrived at the site at 1630Z on 16 January. The total transit from the Azores to the MARK area was 1285 nm and was accomplished in 5 days and 6-1/2 hours, at an average speed of 10.1 knots.

MULTICHANNEL SEISMIC SURVEY

We began deployment of the airguns for the multichannel seismic work at 1641Z on 16 January. The ten-gun, 5346 cu.in., airgun array was in the water by 1740Z. Deployment of the 96 channel, 2.7 km MCS streamer began at 1743Z and was completed by 2300Z. A minor amount of streamer work was done during the deployment: can #1 and the adjacent streamer section were replaced; can #14 was replaced; and oil was added to some of the aft-most sections.

The first shot was recorded at 0053Z 17 January and the MCS survey lasted for approximately 3-1/2 days, with no interruptions. Poor weather, with 10-20 ft seas and 30-40 kt winds, was common during the early part of the survey. However, sea state conditions gradually improved and were excellent during the latter half of the experiment. Previous Sea Beam surveys of the MARK area combined with real-time bathymetry, enabled us to more accurately navigate the seismic lines and follow specific features. Table 1 summarizes the seismic acquisition parameters used throughout the survey. Table 2 lists the start and end times, positions, and tape numbers for the 16 seismic lines shot during the experiment. Figure 2 shows the location of the survey track lines. In addition to the multichannel data, 12 sonobuoys were deployed throughout the survey (Table 3).

The first line shot (Line 1) was a long profile run down the rift valley, approximately following the Purdy and Detrick refraction line. Because the streamer was not properly balanced, the towing depth was quite variable, and resulted in high noise levels on some sections. During this line, Sea Beam recording was down from 0838Z 17 January to 1011Z due to failure of the Eclipse computer. The computer, which had been partially removed from the instrument rack to isolate it from shot-related vibrations, was jolted back into the rack after the ship experienced a large roll due to poor weather. During this period, navigation was hindered, and the ship drifted about 1 mile west of the intended track.

At the termination of Line 1, an additional 36 lbs of weight was added to the front of

the streamer, and throughout the rest of the survey the towing depth was kept relatively constant at ~30 feet. We next shot 5 profiles (lines 3, 5, 7, 9 and 11) across the rift valley. Each profile, except line 11, was about 50 km long and extended across the rift valley to the crests of the adjacent rift mountains. The short, connecting segments (lines 4, 6, 8 and 10) were run along the crest of the rift mountains.

Line 3 is the southernmost profile and is in the area of the Toomey et al. microearthquake experiment. Lines 5 and 9 traverse through ODP sites 648 and 649, respectively. Line 7 passes through the 23°15'N discordant zone. Line 11, which was located just south of the ridge-transform intersection, runs across the inside-corner of the transform and was terminated in the axis of the rift valley.

Line 12 runs south, along the axis of the median ridge and through ODP Site 649. Sea Beam was effective in helping to keep the ship positioned atop this narrow ridge. No shooting was done on the transit between lines 12 and 13 because of airgun and compressor maintenance work. Line 13 was a long profile shot along the crest of the eastern rift mountains extending from about 23°N to north of the Kane fracture zone. The southern portion of line 13 was difficult to navigate due to a failure of Sea Beam which occurred at 0103Z on 20 January combined with infrequent navigation satellite fixes. Upon completion of line 13, a short profile was run across the nodal basin at the eastern intersection of the Kane transform (line 15). The final seismic profile (line 16) is an extension of line 11 so that coverage extends further eastward across the rift valley and into the eastern rift mountains.

Multichannel data acquisition was ended at 1855Z on 20 January. The airguns were aboard by 1945Z, and streamer recovery was completed by 2230Z. Upon retrieval, the streamer appeared to be in good condition, as only one section required patching which was due to a puncture. The tail buoy was not intact and was difficult to see until it was in very close range of the ship. The entire mast along with its flashing beacon light were missing from the tail buoy. The airguns were in fine mechanical condition, with the only minor problem being that two guns had become entangled in fishing line.

SEDIMENT POND SURVEYS

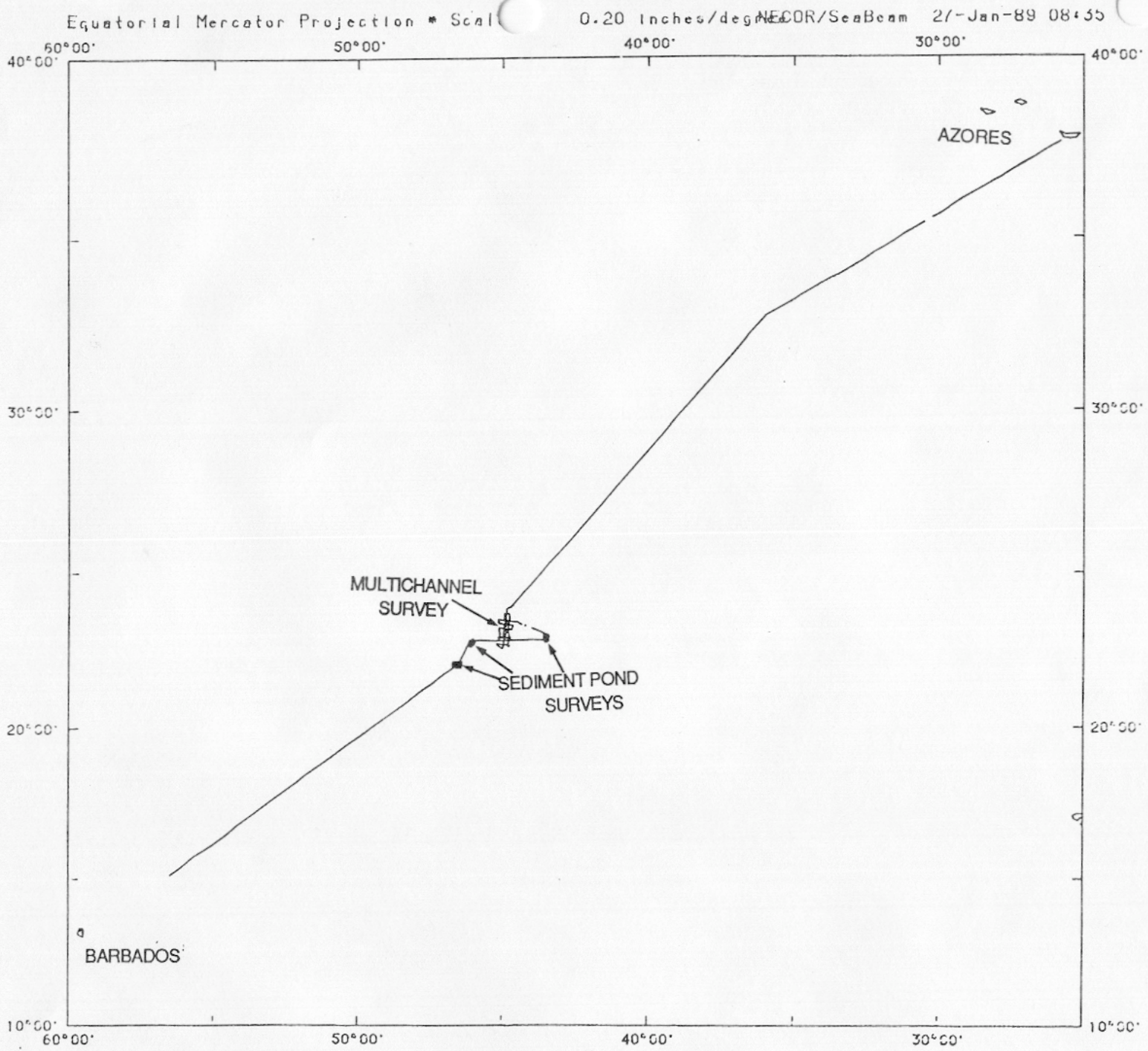
Following completion of the multichannel seismic work, we got underway at full speed for Site 396, where the first sediment pond survey was planned. While enroute to the site, the Sea Beam system crashed due to a malfunction of the Eclipse computer. The problem appeared to be loose fittings between the boards and connectors, and once they were reseated, the system was back on line.

The Site 396 sediment pond survey began at 0351Z on 21 January. The survey took about 18 hours and consisted of 11 Sea Beam lines and 5 watergun single channel seismic profiles (Figure 3). The reflection data were shot with an 80 cu.in. watergun fired at 12 s repetition rate. The data were recorded with a 2 msec sample interval and 10 sec record length. The survey was completed 2202Z on 21 January, and the watergun was recovered

for transit to Site 395, the location of the second sediment pond survey.

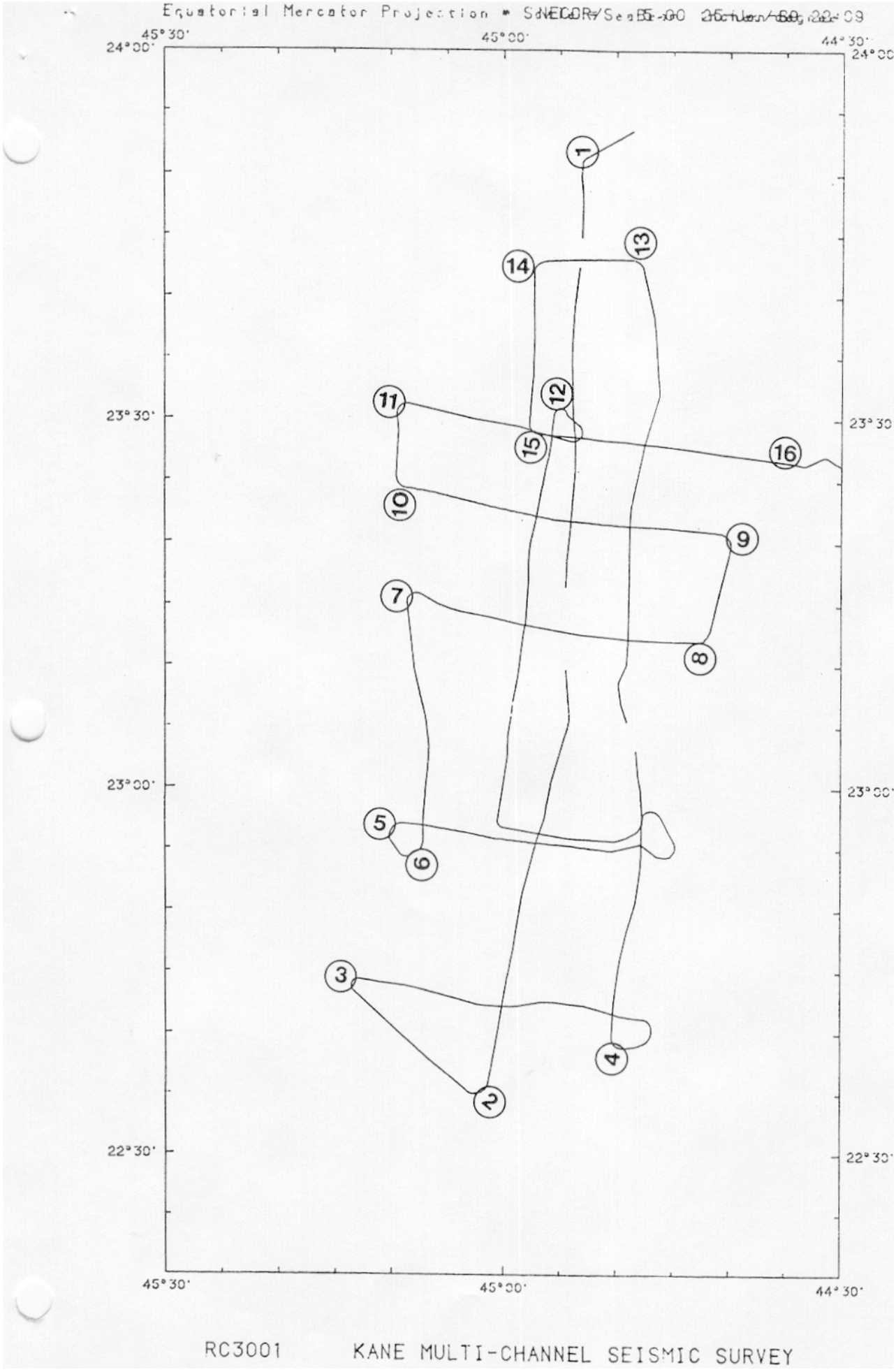
We arrived at Site 395 at 1020Z on 22 January, and the survey was completed at 0300Z 23 January. Next, we proceeded southwest to "South Pond", an area near 22°05'N, 46°40'W. Upon arrival at 0730Z on 23 January, three reconnaissance lines, each about 20 nm long, were run E-W through this area to determine if a sufficiently large sediment pond was present at all. A large, E-W oriented, pond about 10 nm long and 4 nm wide was found, suggesting it was associated with a small fracture zone. After calling Marc Langseth to find out if this sediment pond was suitable for their proposed heat flow work, we continued with the survey. The Sea Beam and watergun reflection survey was completed in 19 hours, and was finished at 1210Z on 24 January (Figure 3).

The ship left the MARK area at 1210Z on 24 January and proceeded at full speed for Barbados. During this 4-day transit, Sea Beam, gravity and magnetics were routinely recorded. As we reached the 200 nm limit of Barbados, at 0000Z on 27 January, the main lab watch and data acquisition, were terminated. The R/VCONRAD docked in Bridgetown, Barbados at 1100Z on 28 January, 1989. After arrival, a gravity tie-in was done by the science officer, and Leg 30-01 was concluded.

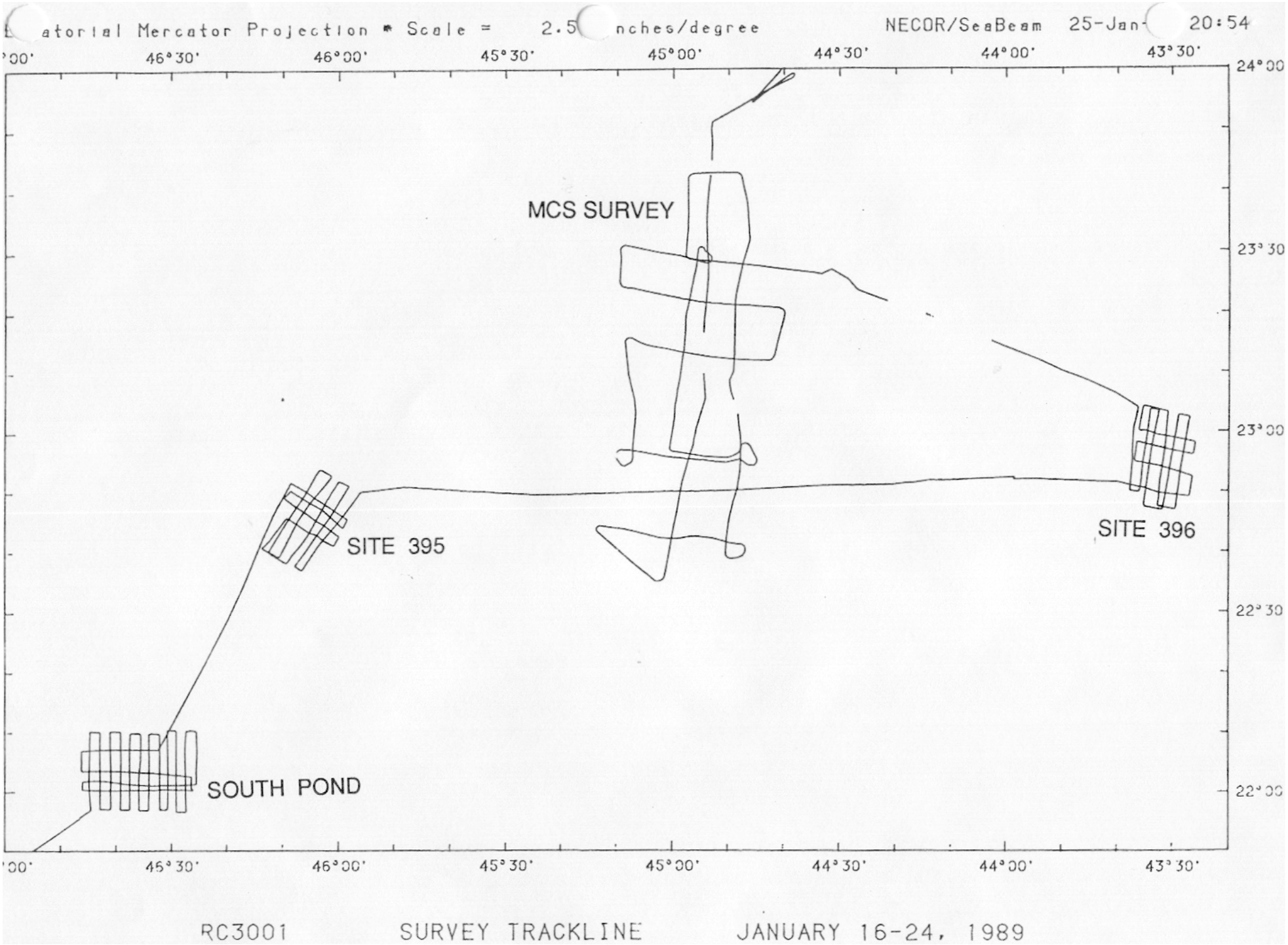


RC3001 AZORES TO BARBADOS JANUARY 11-28, 1989

FIGURE 1



RC3001 KANE MULTI-CHANNEL SEISMIC SURVEY



RC3001 SURVEY TRACKLINE JANUARY 16-24, 1989

TABLE 1 - SEISMIC ACQUISTION AND RECORDING PARAMETERS

Streamer:

96 channels
4 channels/digitizing cannister
25 m group spacing
4 compasses
13 remotely controlled depth transducers
2.4 km long streamer

Airguns:

10 airgun array
5346 in^3 air/shot
22 second shot time
50 m shot interval
4 compressors (total ? SCFM)

Recording:

22 second shot interval
4 msec sample rate
16 sec record length
0 sec trip delay
3 Hz lo cut filter
80 Hz hi cut filter

TABLE 2 - MCS REFLECTION PROFILES

Line	Date/Time Start	Date/Time End	Degrees Lat/Lon Start	Degrees Lat/Lon End	SP's	Data Tapes	Miles
MARK-1	17 Jan 00:57:59Z	17 Jan 18:00:00Z	23 51.2'N 44 52.7'W	22 35.6'N 45 01.6'W	0015-2819	1 to 22	74.6
MARK-2	17 Jan 19:44:32Z	17 Jan 21:35:11Z	22 38.3'N 45 07.3'W	22 43.7'N 45 13.4'W	3102-3403	23 to 26	7.5
MARK-3	17 Jan 22:00:39Z	18 Jan 03:30:00Z	22 44.3'N 45 12.7'W	22 39.8'N 44 46.5'W	3472-4367	28 to 35 (no tape 27)	24.6
MARK 4	18 Jan 03:56:36Z	18 Jan 08:36:12Z	22 39.2'N 44 47.0'W	22 58.0'N 44 47.4'W	4444-5205	38 to 43 (no tapes 36 and 37)	20.7
MARK 5	18 Jan 08:46:40Z	18 Jan 14:14:00Z	22 58.3'N 44 46.6'W	22 57.0'N 45 09.0"W	5234-6129	45 to 52 (no tape 44)	25.4
MARK 6	18 Jan 15:35:50Z	18 Jan 19:36:24Z	22 55.9'N 45 07.1'W	23 15.8'N 45 08.4'W	6350-7006	53 to 58	18.4
MARK 7	18 Jan 19:51:07Z	19 Jan 01:03:51Z	23 16.0'N 45 07.5'W	23 12.6'N 44.41.8'W	7046-7900	59 to 66	25.0
MARK 8	19 Jan 01:28:01Z	19-Jan 02:51:00Z	23 13.5'N 44 41.4'W	23 19.8'N 44 39.8'W	7965-8196	67 to 71 (no tapes 69 and 70)	6.9
MARK 9	19 Jan 02:57:00Z	19 Jan 08:21:09Z	23 20.2'N 44 39.9'W	23 23.9'N 45 09.2'W	8210-9091	72 to 78	26.3

Line	Date/Time Start	Date/Time End	Degrees Lat/Lon Start	Degrees Lat/Lon End	SP's	Data Tapes	Miles
MARK 10	19 Jan 08:30:29Z	19 Jan 09:37:35Z	23 24.5'N 45 09.8'W	23 30.7'N 45 09.4'W	9118-9327	79 to 80	5.0
MARK 11	19 Jan 09:45:51Z	19 Jan 12:25:37Z	23 31.3'N 45 08.9'W	23 29.0'N 44 56.0'W	9328-9757	81 to 84	12.8
MARK 12	19 Jan 14:04:55Z	19 Jan 20:56:21Z	23 30.0'N 44 55.6'W	22 57.2'N 45 00.8'W	10029 -11151	85 to 95	31.3
MARK 13	19 Jan 23:37:10Z	20 Jan 09:33:32Z	22 56.1'N 44 48.3'W	23 42.7'N 44 47.6'W	11590 -13216	96 to 108	47.6
MARK 14	20 Jan 09:42:17Z	20 Jan 11:10:00Z	23 43.1'N 44 48.2'W	23 42.0'N 44 57.5'W	13240-13478	109 to 110	6.8
MARK 15	20 Jan 11:27:33Z	20 Jan 13:56:48Z	23 41.9'N 44 57.5'W	23 29.5'N 44 57.9'W	13528-13935	111 to 114	12.3
MARK 16	20 Jan 14:16:36Z	20 Jan 18:53:56Z	23 29.0'N 44 56.6'W	23 26.4'N 44 33.3'W	13989-14744	115 to 120	21.2
						Total	366.4

TABLE 3 - SONOBUOYS

Sonobuoy	Date	Time Start	Time End	Degrees Lat/Lon Start	Degrees Lat/Lon End	MCS Tape Start	MCS Tape End
1 (MARK-1)	17 Jan	05:47Z	08:07Z	23 28.4'N 44 53.8'W	23 18.7'N 44 54.3'W	7	10
2 (MARK-1)	17 Jan	11:10Z	14:25Z	23 04.0'N 44 54.'W	22 50.0'N 44 58.0'W	14	18
3 (MARK-1)	17 Jan	14:32Z	18:00Z	22 50.0'N 44 58.0'W	22 35.0'N 45 02.0'W	18	22
4B (MARK-4)	18 Jan	07:02Z	08:36:12Z	22 50.2'N 44 48.2'W	22 39.2'N 22 58.0'W	41	43
5 (MARK-10)	19 Jan	08:40Z	09:37Z	23 25.4'N 45 09.8'W	23 30.7'N 45 09.4'W	79	80
6 (MARK 11)	19 Jan	10:07Z	12:25Z	23 31.3'N 45 07.5'W	23 29.0'N 44 56.0'W	81	84
7 (MARK-12)	29 Jan	15:10Z	18:25Z	23 24.0'N 44 56.6'W	23 09.1'N 44 58.4'W	86	92
8 (MARK-12)	19 Jan	18:47Z	20:56:21Z	23 07.3'N 44 58.6'W	22 56.9'N 45 00.6'W	92	95
9 (MARK-13)	20 Jan	00:22Z	02:49Z	23 00.0'N 44 48.0'W	23 11.1'N 44 49.0'W	96	100
10 (MARK-13)	20 Jan	02:55:30Z	05:19:46Z	23 11.6'N 44 49.0'W	23 23.0'N 44 48.7'W	100	103
11 (MARK-13)	20 Jan	05:42Z	07:32:29Z	23 24.7'N 44 48.4'W	23 33.5'N 44 46.4'W	103	106
12 (MARK-14)	20 Jan	09:49Z	11:08:57Z	23 43.1'N 44 48.8'W	23 43.0'N 44 56.5'W	109	110

RESEARCH VESSEL ROBERT D. CONRAD

Nationality - U.S.A.
Reg.# - NY2665BY
Departure - Ponta Delgada, Azores

Port of Registry - New York, New York
Gross Tons - 1072; Net Tons - 397
Date - 11 January, 1989

Crew List

#	Name	Position	Nationality/P/P #	D.O.B.
1	O'Loughlin, James E.	Master	USA 032217898	11-Oct-59
2	Young, Ian W.	Chief Mate	USA F063899	28-Dec-55
3	Zeigler, Stanley P. Jr.	Second Mate	USA G863265	16-May-49
4	Eberhard, Michael J.	Third Mate	USA 110137439	1-Aug-66
5	Santini, John J.	Boatswain	USA 040053519	25-Feb-27
6	Heinze, Blaine A. Jr.	Able Seaman	USA 041615523	28-Nov-53
7	Murley, Daniel K.	Able Seaman	USA 100172074	4-May-61
8	Olander, Hans P.	Able Seaman	BRITISH 112074	22-Dec-64
9	Connolly, Clyde B.	Ordinary Seaman	USA 110272683	6-Jun-34
10	Hanna, Darrell A.	Ordinary Seaman	USA E14237152	12-Feb-58
11	Phillips, Donald E.	Chief Engineer	USA 070769553	26-Sep-23
12	Pica, Stephen M.	First Asst/Engr	USA 100254138	16-Oct-57
13	Tucke, Matthew S.	2nd Asst/Engr	USA G575687	10-Oct-59
14	Walsh, Albert H.	3rd Asst/Engr	USA H291637	2-May-64
15	Buccioni, Ventura B.	Oiler	CHILE 6245	10-Aug-28
16	Santos, James E.	Oiler	USA 100323463	1-May-41
17	Spruill, Michael L.	Oiler	USA 050999621	3-Apr-54
18	Price, Pamela W.	Steward	USA 070135633	28-May-30
19	Moqo, Luke	Messman	FIJI 238636	3-Jul-45
20	Paloney, Frank	Messman	USA 051540667	28-Sep-25

List of Scientists and Technicians

21	Mutter, John C.	Chief Scientist	AUST G333638	1-May-48
22	Detrick, Robert S.	Chief Scientist	USA C2211096	19-Nov-49
23	Blaes, Robert J. Jr.	Technician	USA E762289	7-Oct-60
24	Dolan, James	Technician	USA 100095816	30-Jun-55
25	Iltzsche, Martin W.	Technician	WGER H5059788	8-Jan-39
26	Maiwiriwiri, Ropate Q.	Technician	FIJI 187094	10-Apr-41
27	Miller, Joyce E.	Technician	USA F1454659	14-Jun-47
28	Morris, Ellen	Scientist	USA 100276894	27-Sep-60
29	Nolan, Timothy J.	Technician	USA Z4507939	19-Apr-58
30	Robinson, Frank	Technician	USA D497287	7-Apr-55
31	Ross, Aaron M.	Scientist	USA 071311530	1-Apr-60
32	Stennet, Joseph N.	Science Officer	USA H308435	8-Jun-36
33	Su, Wusi	Scientist	China 202430	4-May-42

Total Crew, Scientists, and Technicians = 33