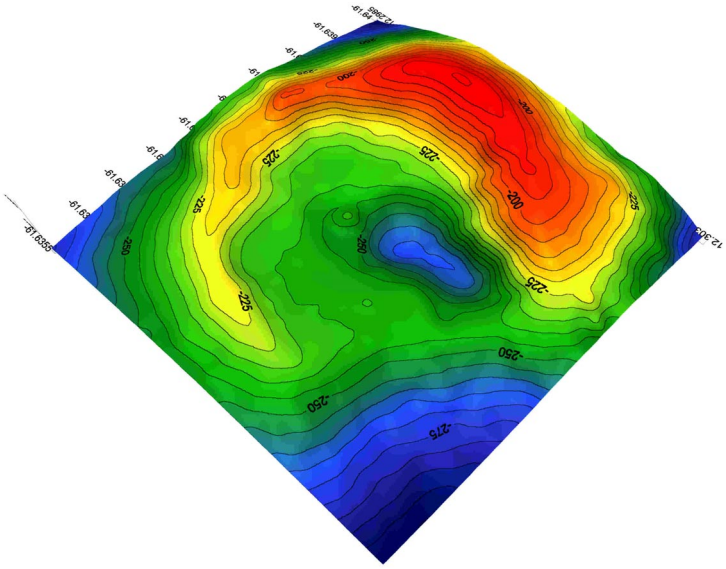
NOAA Cruise Report
R/V Ronald Brown RB-03-03



Project title: Kick'em Jenny Submarine Volcano

Cruise Dates: March 10, 2003 through March 21, 2003

Vessel and Cruise Number: R/V Brown, cruise RB-03-03

Operating Area: Grenada Basin, Caribbean Sea

Chief Scientist: Dr. Haraldur Sigurdsson
Graduate School of Oceanography
University of Rhode Island
Narragansett, RI 02882
Tel: 401-874-6596
Fax: 401-874-6811
E-mail: haraldur@gso.uri.edu

I. Project Goals and Objectives

Kick'em Jenny is a submarine arc volcano located 7.5 km north of the island of Grenada in the Lesser Antilles volcanic arc (fig. 1). It has erupted at least 12 times since 1939 and is the most active volcano in the West Indies. The most recent eruption took place in December, 2001. Although recognized as a hazard because of its explosive activity, recent multi-beam surveying conducted by NOAA in March 2002 revealed evidence of a potentially more dangerous and widespread hazard from large-scale flank failure and debris avalanche generation (fig. 2). With a summit depth of only 180 meters, Kick'em Jenny provides a unique natural laboratory to study the activity and emergence of a young volcanic arc island.

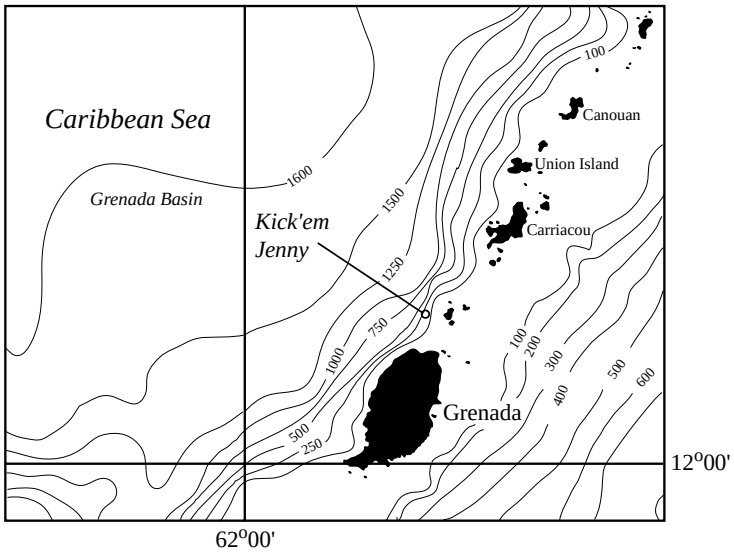


Figure 1. Map of the southern Lesser Antilles showing the location of Kick'em Jenny submarine volcano. Bathymetric contours are in meters.

Cruise RB-030-03 onboard the *R/V Ronald Brown* was a joint research project between the Seismic Research Unit of the University of the West Indies, the university of Rhode Island and NOAA/OAR Chesapeake Bay Office. The primary objectives of this cruise were to: 1) conduct multi-beam mapping of Kick'em Jenny submarine volcano and adjacent areas in the Grenada Basin, 2) conduct seismic profiling transects on the slopes of the submarine volcano and into the adjacent Grenada Basin, 3) deploy an ROV for the purpose of video observations and sample collection on the submarine volcano and its flanks, 4) carry out CTD measurements in the vicinity of the submarine volcano's crater and flanks to detect hydrothermal activity, 5) collect sediment cores on the flanks of the submarine volcano and in the adjacent Grenada Basin, and (6) carry out biological sampling in and around the submarine volcano.

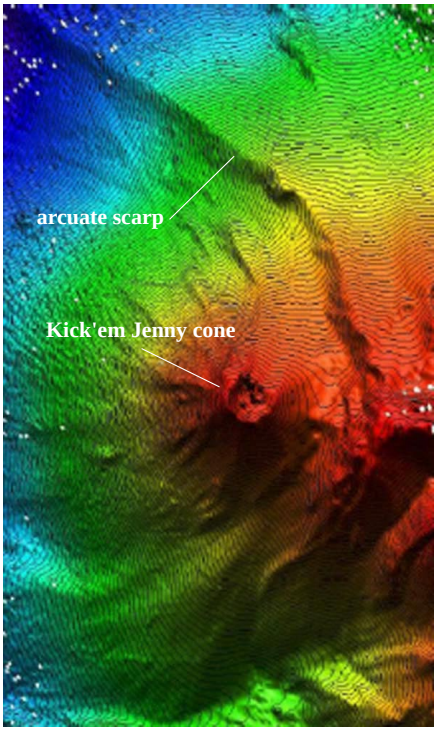


Fig.2. Morphology of Kick'em Jenny volcano as revealed by a multi-beam survey by NOAA's R/V Ronald Brown in March 2002. The survey shows that the modern cone of the volcano is nested within a larger horse-shoe shaped depression, probably formed by slope failure and debris avalanche generation. Crater diameter is approximately 300 m and the contour interval is 10 meters. Depth to the crater rim is about 190 meters.

The cruise departed San Juan, Puerto Rico on March 10 and finished in St. Georges, Grenada on March 21, 2003. The operating area was the southern Lesser Antilles to the west of the island of Grenada and into the southern Grenada

Basin (Eastern Caribbean Sea). The crater of Kick'em Jenny volcano is located at approximately 12 °18'N, 61 °38.3'W, and it is at about 180 m below sea level. A cruise track for RB-03-03 in the Lesser Antilles area is shown in figure 3.

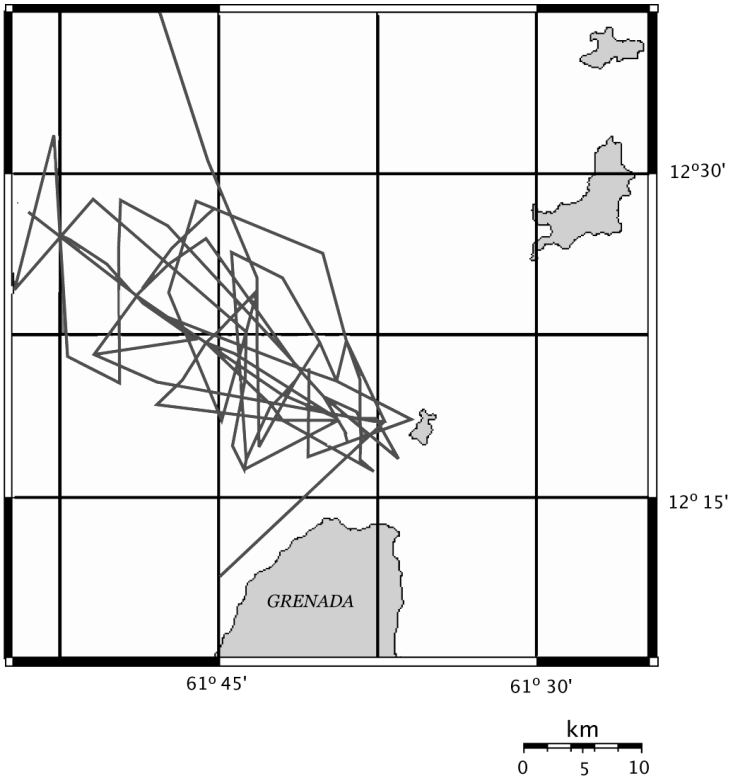


Figure 3. Cruise track for cruise RB-03-03 in the southern Lesser Antilles area.

II. Participating Scientists/Personnel:

Name	Title	Sex	Nat.	Affiliation
1. Haraldur Sigurdsson	Chief Scientist, Oceanographer	M	US	GSO/URI
2. John B. Shepherd	Geophyscist, co-PI	M	UK	SRU
3. Steven Carey	Marine Geologist, co-PI	M	US	GSO/URI
4. Doug Wilson	Physical Oceanographer, co-PI	M	US	NOAA/OAR
5. Karen Wishner	Biological Oceanographer	F	US	GSO/URI
6. David Smith	Biological Oceanographer	M	US	GSO/URI
7. Dave Lovalvo	Engineer	M	US	Eastern Oceanics
8. Martin Bowen	ROV pilot	M	US	Eastern Oceanics
9. Kim Edward Wallace	ROV technician	M	US	Eastern Oceanics
10. Dwight Coleman	Graduate Student	M	US	GSO/URI
11. Cameron Walker	Engineer	M	US	Walker Marine
12. Trinny L. Walker	Technician	F	US	Walker Marine
13. Steinthor Sigurdsson	Technician	M	Iceland	Walker Marine
14. Scott Lundin	Geology Graduate Student	M	US	GSO/URI
15. Andrew Staroscik	Biology Graduate Student	M	US	GSO/URI

16. Kevin Brown	Technician	M	US	UVI
17. Celeste V. Mosher	Technician	F	US	UVI
18. Lincoln Critchley	Technician	M	US	UVI

Affiliation Addresses:

SRU: Seismic Research Unit, University of the West Indies, St. Augustine, Trinidad.
GSO/URI: Graduate School of Oceanography, URI, South Ferry Rd., Narragansett, R.I. 02882.
NOAA/OAR: Cheasapeake Bay Office, 410 Severn Ave., Annapolis, MD 21403.
SRU: Seismic Research Unit, University of the West Indies, St. Augustine, Trinidad.
UVI: University of the Virgin Islands, St. Thomas, U.S. Virgin Islands.
Eastern Oceanics: 25 Limekiln Road, West Redding, CY 06896.
Walker Marine: 2871 North Ocean Blvd., Diano 312, Boca Raton, FL 33431.

III. Methodologies

SEABEAM mapping

SEABEAM mapping was carried out using the R/V Brown's 2112 multi-beam system over an area of approximately 1100 km^2 (fig. 4). The principal objectives of the mapping were to 1) search for evidence of a large-scale debris avalanche deposits associated with the prominent

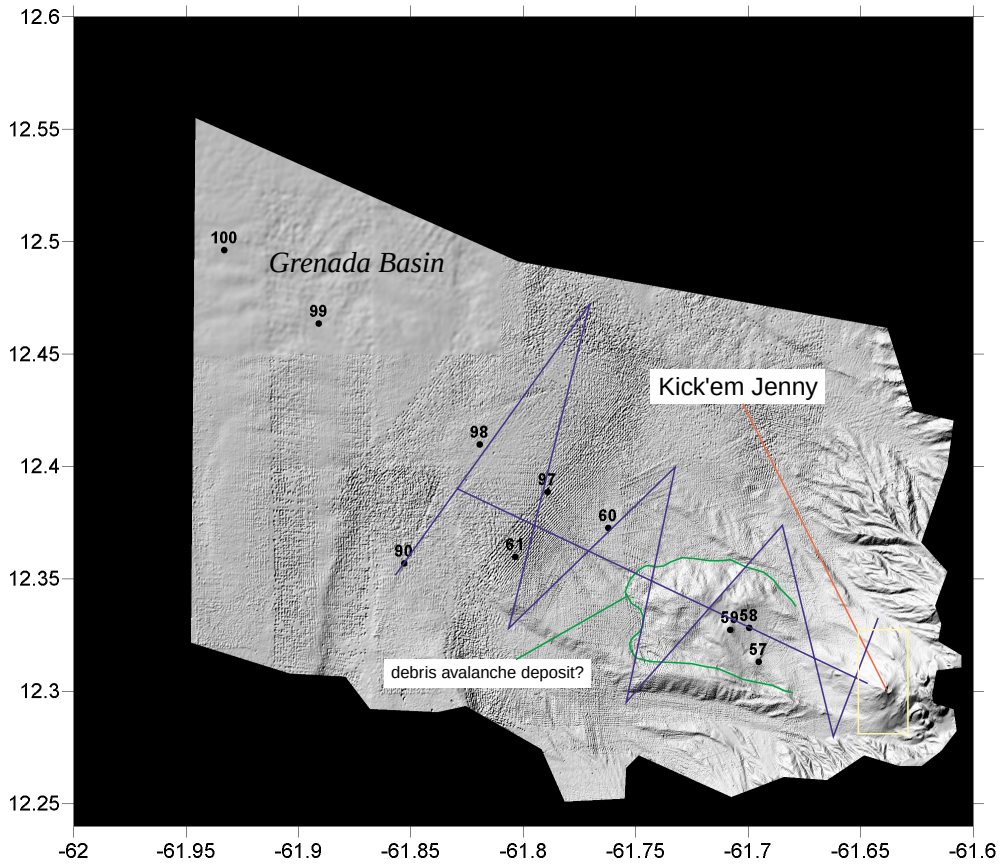


Figure 4. SEABEAM survey map of the Kick'em Jenny submarine volcano and adjacent area of the Grenada Basin, Lesser Antilles. Blue lines are multichannel seismic profiles. Sediment gravity cores are shown as solid circles and the green line indicates the inferred extent of the Kick'em Jenny debris avalanche deposit. Yellow box denotes the area surveyed in 2002 and shown in fig. 2.

horseshoe-shaped scar that was revealed by the 2002 SEABEAM mapping, 2) examine any changes in the crater area that might be associated with the eruptive activity between 2002 and 2003, and 3) define the morphology of the volcano's flanks and any associated geologic features. The mapping revealed what appears to be a significant debris avalanche deposit that extends at least up to 18 km from Kick'em Jenny (fig. 5). In addition, several new volcanic centers were discovered to the northeast, east and southeast of Kick'em Jenny (fig. 6). Three are conical in shape with well-defined craters, whereas two have a dome-like morphology. One of the cones, provisionally named Kick'em Jack, is similar in size to Kick'em Jenny and exhibits a horse-shoe shaped crater with an interior dome.

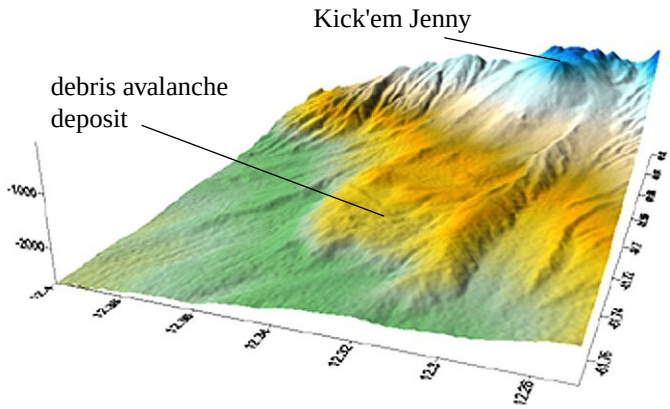


Figure 5. Perspective plot of SEABEAM survey data in the Kick'em Jenny area showing the inferred debris avalanche deposit extending into the Grenada Basin.

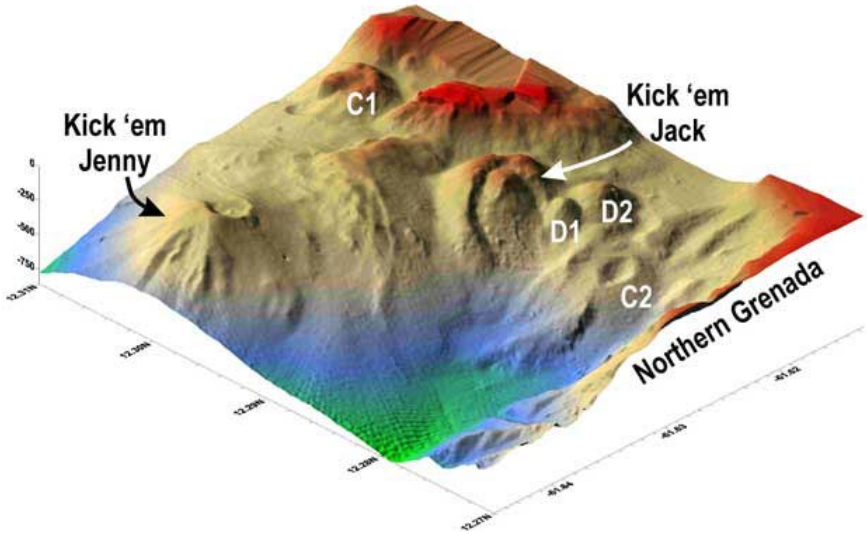


Figure 6. SEABEAM map of the Kick'em Jenny area showing the location of newly discovered cones (C1, C2 and Kick'em Jack) and domes (D1 and D2).

Seismic Surveying

A low-power, high resolution multichannel seismic profiling survey was carried out on the flanks of Kick'em Jenny and the adjacent Grenada Basin to examine the stratigraphic relationships of any potential debris avalanche or other volcaniclastic deposits (fig. 4). The system was operated under subcontract by Walker Marine and consisted of (2) Bolt 600B air guns ranging in volume from 1.5 to 20 cubic inches. Streamers were dual 48 channel digital, (1) 96-channel digital configurations. The compressors were (1) 9.9 SCFM Bauer and (1) 5.9 SCFM Bauer. Data was collected on a SeaMux 2000-24 NT 24-bit digital recording system. A total of approximately 100 kms were surveyed during the cruise using this system.

ROV Exploration

Exploration of Kick'em Jenny's crater, flanks, and adjacent areas was accomplished using the Oceanic Explorer ROV with a depth rating of 1000 m, equipped with fiber optic telemetry. A

dedicated winch was mounted on deck for the ROV, and a 36” sheave on the A-frame. The ROV included a number of visual tools that transmitted directly via fiber-optic cable to the ship, including a three-chip broadcast quality camera and color video camera, supported by HMI and halogen lighting. The ROV was deployed for a total of 7 dives and just over 45 hours of color video were recorded. A five-function hydraulic manipulator arm on the ROV was used to grab samples (30), take box (6) and push cores (2), and obtain biological samples through suction (6) and syringe devices (11). The ROV was equipped with a ultra short baseline tracking system and a navigation system to allow for precise location during deployment.

A major finding of the ROV work was the discovery of hydrothermal vents within the crater of Kick’em Jenny at a depth of approximately 250 meters (fig. 7). These vents displayed a variety

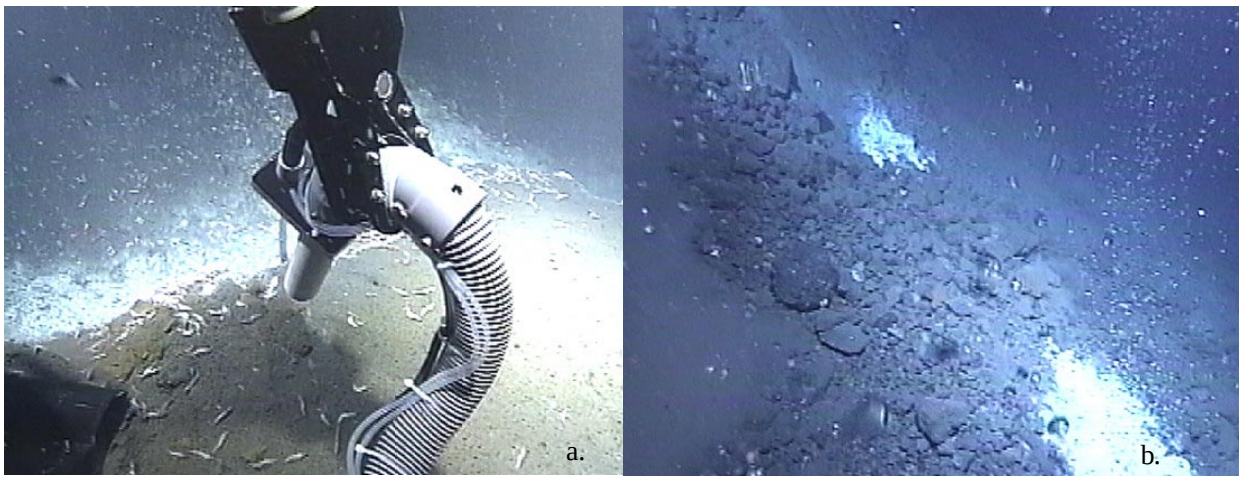


Figure 7. Hydrothermal vents in a) hummocky sediment and b) talus within the Kick'em Jenny crater. Both vents are emitting gas bubbles and warm water. White elongated objects around the vent opening in a) are shrimp. ROV suction tube in a) is about 10 cm in diameter. Largest rocks in b) are approximately 40 cm in diameter.

of features. Some discharged gas and fluids, whereas other discharged only fluids. An attempted push core close to one of the vents resulted in a melted core liner (~270° C) at a depth of only 10 cm below the sediment surface. Most vents were associated with robust biological activity in the form of abundant shrimp and polychaete worms. Grab samples collected close to one of the vents recovered indurated basaltic clasts that contain interstitial sulphide mineralization.

Sediment Coring and Shipek grabs

A 2-meter large diameter gravity corer was used to collect 10 sediment cores on the surface of the debris avalanche deposit on the flanks of Kick’em Jenny (fig. 4). The cores will be used to examine the lithology of volcaniclastic sediments derived from Kick’em Jenny and, if possible, to establish the timing of debris avalanche generation. In addition to the bottom sampling carried out using the ROV we also deployed a Shipek grab sampler to collect surface sediment samples in the Kick’em Jenny crater. 25 grabs were obtained during a high resolution grid sampling program (fig. 8).

CTD profiling

The R/V Brown's CTD system was equipped with a nephelometer and used to conduct a series of CTD profiles around the Kick'em Jenny crater in order to search for evidence of hydrothermal fluid venting. The system was deployed in a "pogo" mode as the ship transited around the circumference of the crater. In addition, a single CTD profile was done at the beginning of the cruise to serve as a calibration for the SEABEAM system.

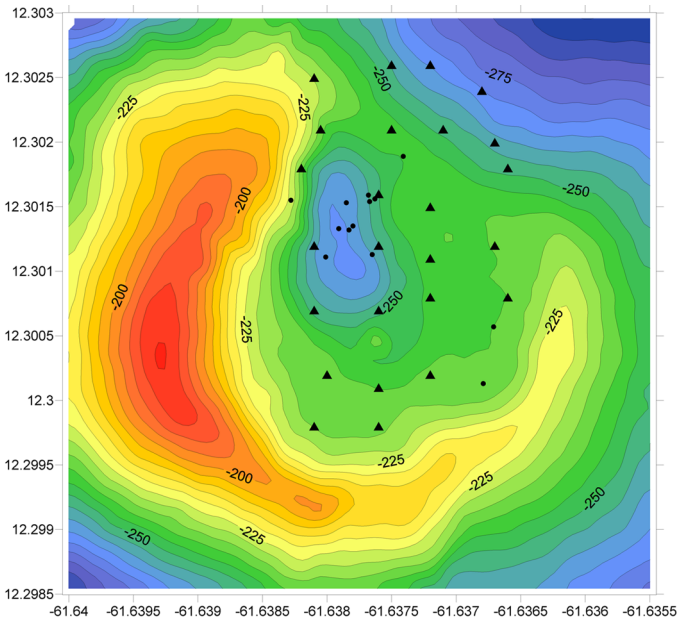


Figure 8. Locations of Shipek grab samples (triangles) and ROV samples (circles) in the crater of Kick'em Jenny. The diameter of the crater is about 300 meters. Contour intervals in meters.

Plankton Tows

A bongo plankton net was deployed to obtain biological samples in the upper 200 meters of water surrounding Kick'em Jenny. The objectives were to characterize the background plankton community and search for anomalies that might be influenced by hydrothermal venting at the volcano.

IV. Summary of Operations

A summary of operations for cruise RB-03-03 is provided in table 1 on the next page.

V. Milestones Achieved

Cruise RB-03-03 was highly successful in terms of the objectives initially identified for the project. The milestones achieved during the cruise include:

1. 1100 km^2 were surveyed with SEABEAM with 50% overlap between swaths
2. 100 kms were surveyed using high resolution multichannel seismics
3. 7 ROV dives were completed in the crater of Kick'em Jenny and the surrounding volcanic centers
4. A pogo-style CTD survey was carried out around the entire crater circumference of Kick'em Jenny
5. 11 gravity cores were recovered using a large diameter gravity corer
6. 30 grab samples were obtained using the ROV
7. 6 box cores and 2 push cores were obtained using the ROV
8. 6 suction and 11 syringe biological samples were obtained using the ROV
9. 30 grab samples were obtained using a Shipek grab sampler
10. Approximately 45 of color video tape was collected by the ROV

Table 1. Summary of Operations for R/V Brown Cruise RB-03-03

Operation	Sample Number	Date	Start Time (GMT)	End Time (GMT)	Start Latitude	Start Longitude	End Latitude	End Longitude	Depth (m)	Dive no.
SEABEAM survey		3/12/03	16:00		12o20.2057	61o41.6763				
SEABEAM survey		3/13/03		1:01			12o18.281	61o37.8398		
SEABEAM survey		3/13/03	1:21		12o19.4301	61o38.5479				
SEABEAM survey		3/13/03		17:05			12o18.0923	61o38.374		
CTD cast		3/13/03	17:05		12°18.027	61o38.311				
SEABEAM survey		3/13/03	18:10	22:44	12o18.0475	61o38.242	12o18.0475	61o38.242		
CTD survey (pogo)		3/13/03	18:45	22:44	12o18.039	61o38.257	12o18.039	61o38.257		
SEABEAM survey		3/14/03	0:13	9:42	12o27.6638	61o47.4253	12o24.4108	61o45.5352		
Bongo net tow	RB-03-03-01a-BT	3/14/03	14:21		12o19.450	61o38.676			1080	
Bongo net tow	RB-03-03-01b-BT	3/14/03	14:21		12o19.450	61o38.676			1080	
Bongo net tow	RB-03-03-02aBT	3/14/03	15:22		12o17.418	61o39.002			833	
Bongo net tow	RB-03-03-02b-BT	3/14/03	15:22		12o17.418	61o39.002			833	
Deploy ROV		3/14/03	18:05	20:01	12o18.418	61o35.97				1
SEABEAM survey		3/14/03	22:58		12o20.0386	61o38.9097				
SEABEAM survey		3/15/03		9:37			12o25.4545	61o39.8755		
Deploy ROV		3/15/03	14:17	21:14	12o18.104	61o38.182	12o17.9493	61o38.2798		2
ROV microbio sample	RB-03-03-03-ROVMIC	3/15/03	15:58		12o18.05	61o38.24			245	
ROV microbio sample	RB-03-03-04-ROVMIC	3/15/03	16:03		12o18.0545	61o38.2430			243	
	RB-03-03-05-ROVMAC	3/15/03			12o18.0654	61o38.82678			259	
ROV grab sample	RB-03-03-06-ROVG	3/15/03	18:42		12o18.0936	61o38.258			245	
ROV grab sample	RB-03-03-07-ROVG	3/15/03	19:14		12o18.1135	61o38.2447			250	
ROV grab sample	RB-03-03-08-ROVG	3/15/03	19:52		12o18.0665	61o38.2807			249	
	RB-03-03-09-ROV	3/15/03	19:53		12o18	61o38				
	RB-03-03-10-ROV	3/15/03	19:53		12o18	61o38				
	RB-03-03-11-ROV	3/15/03			12o18.0654	61o38.82678			259	
Shipek grab	RB-03-03-12-SG	3/16/03	1:00		12o18.725	61o39.496			1112	
SEABEAM survey		3/16/03	5:03	12:00	12o19.0542	61o48.0635	12o16.0363	61o43.5601		
Deploy ROV		3/16/03	14:26	21:03	12o18.0677	61o38.197	12o18.0309	61o38.2603		3
ROV push core	RB-03-03-13-ROVPC	3/16/03	15:07		12o18.0345	61o38.2026			239	
ROV grab sample	RB-03-03-14-ROVG	3/16/03	15:26		12o18.0078	61o38.2078			227	
ROV macrobio sample	RB-03-03-15-ROVMAC	3/16/03	17:25		12o18.076	61o38.256			261	
ROV push core	RB-03-03-16-ROVPC	3/16/03	18:09		12o18.0954	61o38.2610			260	
ROV grab sample	RB-03-03-17-ROVG	3/16/03			12o18.0954	61o38.2610			260	
ROV box core	RB-03-03-18-ROVBC	3/16/03	19:06		12o18.0924	61o38.2605			262	
ROV microbio sample	RB-03-03-19-ROVMIC	3/16/03	20:15		12o18.1004	61o38.2754			257	
Shipek grab	RB-03-03-20-SG	3/16/03	22:09		12o18.148	61o38.286			220	
Shipek grab	RB-03-03-21-SG	3/16/03	22:42		12o18.128	61o38.283			243	
Shipek grab	RB-03-03-22-SG	3/16/03	23:04		12o18.085	61o38.293			218	
Shipek grab	RB-03-03-23-SG	3/16/03	23:37		12O18.071	61o38.284			262	
Shipek grab	RB-03-03-24-SG	3/16/03			12o18.041	61o38.286			235	
Shipek grab	RB-03-03-25-SG	3/17/03	0:40		12o18.013	61o38.282			238	
Shipek grab	RB-03-03-26-SG	3/17/03	0:58		12o17.987	61o38.284			222	
Shipek grab	RB-03-03-27-SG	3/17/03	1:26		12o17.987	61o38.257			215	
Shipek grab	RB-03-03-28-SG	3/17/03	2:17		12o18.007	61o38.259			234	
Shipek grab	RB-03-03-29-SG	3/17/03	2:22		12o18.043	61O38.253			246.5	
Shipek grab	RB-03-03-30-SG	3/17/03	2:47		12o18.07	61o38.256			242	
Shipek grab	RB-03-03-31-SG	3/17/03	3:13		12o18.097	61o38.259			267.3	
Shipek grab	RB-03-03-32-SG	3/17/03	4:01		12o18.124	61o38.248			241	
Shipek grab	RB-03-03-33-SG	3/17/03	4:48		12o18.153	61o38.251			237.3	
Shipek grab	RB-03-03-34-SG	3/17/03	5:15		12o18.153	61o38.231			246.5	
Shipek grab	RB-03-03-35-SG	3/17/03	5:37		12o18.123	61o38.228			239.2	
Shipek grab	RB-03-03-36-SG	3/17/03	6:03		12o18.092	61o38.231			236.6	
Shipek grab	RB-03-03-37-SG	3/17/03	6:35		12o18.0665	61o38.231			238.6	
Shipek grab	RB-03-03-38-SG	3/17/03	7:06		12o18.045	61o38.230			237.6	
Shipek grab	RB-03-03-39-SG	3/17/03	7:37		12o18.013	61o38.233			235.6	
Shipek grab	RB-03-03-40-SG	3/17/03	8:05		12o18.047	61o38.198			236.9	
Shipek grab	RB-03-03-41-SG	3/17/03	8:27		12o18.071	61o38.204			234.3	
Shipek grab	RB-03-03-42-SG	3/17/03	9:00		12o18.111	61o38.196			238.1	
Shipek grab	RB-03-03-43-SG	3/17/03	10:03		12o18.121	61o38.2			243.8	
Shipek grab	RB-03-03-44-SG	3/17/03	10:23		12o18.144	61o38.210			252.4	
Shipek grab	RB-03-03-45-SG	3/17/03	11:04		12o18.905	61o38.459			748.4	
Deploy ROV		3/17/03	12:23	21:38	12o18.917	61o38.514	12o18.7939	61o38.1943		4
ROV box core	RB-03-03-46-ROVBC	3/17/03	13:37		12o18.9027	61o38.4915			794	
ROV grab sample	RB-03-03-47-ROVG	3/17/03	13:50		12o18.9134	61o38.4911			796	
ROV grab sample	RB-03-03-48-ROVG	3/17/03	14:39		12o18.9411	61o38.476			764	
ROV box core	RB-03-03-49-ROVBC	3/17/03	14:50		12o18.9433	61o38.4091			766	
ROV grab sample	RB-03-03-50-ROVG	3/17/03	15:51		12o18.8288	61o38.3504			694	
ROV grab sample	RB-03-03-51-ROVG	3/17/03	17:07		12o18.7709	61o38.3376			643	
ROV macrobio sample	RB-03-03-52-ROVMAC	3/17/03	18:28		12o18.6577	61o38.2560			559	
ROV microbio sample	RB-03-03-53-ROVMIC	3/17/03	19:22		12o18.5159	61o38.2698			489	

Table 1. Cont. Summary of Operations for R/V Brown Cruise RB-03-03

Operation	Sample Number	Date	Start Time (GMT)	End Time (GMT)	Start Latitude	Start Longitude	End Latitude	End Longitude	Depth (m)	Dive no.
ROV grab sample	RB-03-03-54-ROVG	3/17/03	19:34		12o18.5159	61o38.2698			507	
ROV microbio sample	RB-03-03-55-ROVMIC	3/17/03	20:38		12o18.4088	61o38.1417			391	
ROV box core	RB-03-03-56-ROVBC	3/17/03	21:00		12o18.4136	61o38.1413			392	
Gravity core	RB-03-03-57-GC	3/17/03	23:40		12o18.778	61o41.718			1708	
Gravity core	RB-03-03-58-GC	3/18/03	1:41		12o19.690	61o41.976			1820	
Gravity core	RB-03-03-59-GC	3/18/03	3:29		12o19.646	61o42.478			1777	
Gravity core	RB-03-03-60-GC	3/18/03	5:40		12o22.360	61o45.741			2529	
Gravity core	RB-03-03-61-GC	3/18/03	8:11		12o21.585	61o48.215			2554	
Shipek grab	RB-03-03-62-SG	3/18/03	12:55		12o17.455	61o37.313			88	
Deploy ROV		3/18/03	14:42	20:50	12o17.4288	61o37.3152	12o16.8271	61o37.4307		5
ROV grab sample	RB-03-03-63-ROVG	3/18/03	14:46		12o17.4288	61o37.3152			110	
ROV grab sample	RB-03-03-64-ROVG	3/18/03	15:10		12o17.4109	61o37.3369			114	
ROV grab sample	RB-03-03-65-ROVG	3/18/03	15:44		12o17.4208	61o37.4003			135	
ROV grab sample	RB-03-03-66-ROVG	3/18/03	17:01		12o17.2271	61o37.3327			236	
ROV box core	RB-03-03-67-ROVBC	3/18/03	17:27		12o17.2331	61o37.2991			257	
ROV grab sample	RB-03-03-68-ROVG	3/18/03	18:10		12o17.213	61o37.2008			212	
ROV macrobio sample	RB-03-03-69-ROVMAC	3/18/03	19:16		12o16.9789	61o37.3561			327	
ROV grab sample	RB-03-03-70-ROVG	3/18/03	19:54		12o16.8732	61o37.4409			373	
microbio sample	RB-03-03-71-MIC	3/18/03	20:26		12o16.8135	61o37.4506			430	
microbio sample	RB-03-03-72-MIC	3/18/03	20:33		12o16.8166	61o37.4557			434	
macrobio sample	RB-03-03-73-MAC	3/18/03	20:40		12o16.8135	61o37.4506			435	
ROV grab sample	RB-03-03-74-ROVG	3/18/03	20:48		12o16.8262	61o37.4756			423	
Bongo net tow	RB-03-03-75-BT	3/19/03	7:25		12o18.014	61o38.569			351	
Bongo net tow	RB-03-03-76-BT	3/19/03	8:39		12o18.175	61o38.189			274	
SEABEAM survey		3/19/03	9:23	11:39	12o17.316	61o38.125	12o17.4521	61o37.1978		
Deploy ROV		3/19/03	12:17	21:05	12o18.0313	61o38.2371	12o18.0839	61o38.2515		6
ROV box core	RB-03-03-77-ROVBC	3/19/03	13:21		12o18.0836	61o38.189				
ROV grab sample	RB-03-03-78-ROVG	3/19/03	15:14		12o18.0933	61o38.2972			246	6
ROV grab sample	RB-03-03-79-ROVG	3/19/03	16:24		12o18.0677	61o38.259			244	6
ROV grab sample	RB-03-03-80-ROVG	3/19/03	17:36		12o18.0918	61o38.2715			255	6
ROV microbio sample	RB-03-03-81-ROVMIC	3/19/03	18:02		12o18.0816	61o38.2691			250	6
ROV grab sample	RB-03-03-82-ROVG	3/19/03	18:27		12o18.0809	61o38.2681			250	6
ROV macrobio sample	RB-03-03-83-ROVMAC	3/19/03	19:43		12o18.0691	61o38.2921			256	6
microbio sample	RB-03-03-84-MIC	3/19/03	20:25		12o18.0838	61o38.2776			255	6
ROV grab sample	RB-03-03-85-ROVG	3/19/03	20:46		12o18.0796	61o38.2747			256	6
ROV grab sample	RB-03-03-86-ROVG	3/19/03	20:47		12o18.0796	61o38.2744			256	6
ROV grab sample	RB-03-03-87-ROVG	3/19/03	21:03		12o18.0791	61o38.2701			250	6
ROV misc sample	RB-03-03-88-ROVMISC	3/19/03								6
SEABEAM survey		3/19/03	23:15		12o18.1382	61o38.3525				
SEABEAM survey		3/20/03		10:23			12o22.7196	61o46.499		
Gravity core	RB-03-03-89-GC	3/20/03	2:34		12o21.406	61o51.177			2663	
Gravity core	RB-03-03-90-GC	3/20/03	4:08		12o21.41	61o51.18			2663	
Deploy ROV		3/20/03	15:51	20:45	12o18.864	61o38.214	12o18.8195	61o38.1304		7
ROV grab sample	RB-03-03-91-ROVG	3/20/03	16:55		12o18.8820	61o38.1797			625	
ROV grab sample	RB-03-03-92-ROVG	3/20/03	17:12		12o18.8876	61o38.1756			608	
ROV grab sample	RB-03-03-93-ROVG	3/20/03	17:23		12o18.8877	61o38.1709			596	
ROV grab sample	RB-03-03-94-ROVG	3/20/03	17:45		12o18.8811	61o38.1652			583	
ROV grab sample	RB-03-03-95-ROVG	3/20/03	18:10		12o18.8789	61o38.1334			548	
ROV grab sample	RB-03-03-96-ROVG	3/20/03	18:59		12o18.8586	61o38.1608			597	
Gravity core	RB-03-03-97-GC	3/20/03	23:44		12o23.323	61o47.354			2652	
Gravity core	RB-03-03-98-GC	3/20/03	2:02		12o24.587	61o49.170			2718	
Gravity core	RB-03-03-99-GC	3/21/03	4:41		12o27.814	61o53.456			2814	
Gravity core	RB-03-03-100-GC	3/21/03	7:01		12o29.778	61o55.980			2873	
SEABEAM survey		3/21/03	8:10		12o30.1799	61o56.5298				
Shipek grab	RB-03-03-101-SG	3/21/03	18:26		12o18.298	61o37.258			108	
Shipek grab	RB-03-03-102-SG	3/21/03	18:44		12o18.336	61o37.3561			110.5	

VI. Anticipated Benefits

The cruise results at Kick'em Jenny will allow us to address the following questions that bear on the specific details of its submarine activity and the more general aspects of shallow submarine arc volcanism:

What is the nature and extent of debris avalanche deposits? SEABEAM survey data, multichannel seismic profiles, and sediment cores will be used to determine the boundaries of the debris avalanche deposit and explore whether it might be linked to more extensive debris flow deposits in the Grenada Basin.

What was the size of the collapse? Mapping of the surface extent of the debris avalanche deposit coupled with cross sections using multichannel seismic lines will be used to estimate the deposit volume and reconstruct pre-collapse configurations of the source volcano.

When did the collapse occur? Sediment biostratigraphy, litholostratigraphic, and selective dating of sediment samples will be used to determine the age of the debris avalanches deposit if it was penetrated by coring.

What is the nature of submarine eruptions at Kick'em Jenny? Direct examination of the crater area and flanks by ROV and side scan surveying will provide information about the types volcanic deposits (lava flows, domes, volcaniclastics), their relative volumes, and their distribution.

What role have magmatic volatiles played in explosive eruptions of Kick'em Jenny? Examination of the morphology and vesiculation of volcaniclastic particles from Kick'em Jenny will allow us to assess the role of primary degassing versus magma/water interactions during fragmentation associated with explosive events.

What are the pressure/temperature/volatile conditions of Kick'em Jenny magmas prior to eruption? Petrologic studies will help constrain the levels of magma storage and degree of volatile saturation prior to eruption. Knowledge about the magma chamber beneath Kick'em Jenny is critical for understanding the impact of flank failure and its potential for generating associated eruptions.

What processes are involved in the petrogenesis of magmas in the Kick'em Jenny area? A combination of trace elements and isotopes will be used to assess the petrogenetic relationship of recovered magmas and the nature of potential source material involved in their generation. In particular, the role of crustal assimilation, slab fluids, and incorporated sediment will be evaluated.

What is the extent and nature of hydrothermal venting and mineralization in the crater of Kick'em Jenny?

ROV videotapes and high resolution SEABEAM data will be used to generate a detailed map of the hydrothermal vent distribution in the crater. XRD and electron microprobe analyses of mineral precipitates will provide information about the types of minerals that are forming in and around the vents and allow for comparisons with other hydrothermal systems.

What is the nature of the newly discovered volcanic centers near Kick'em Jenny? Petrologic studies, dating, and evaluation of ROV videotapes will provide new information about 1) their relationship to Kick'em Jenny from a petrologic perspective, 2) their relative ages and activity level, 3) the processes by which they have formed.

What types of hazards do future eruptions of Kick'em Jenny pose? By documenting the types of submarine eruptive processes and the nature of potential flank failures the proposed work will provide important constraints on the types of hazards to the southern Lesser Antilles area that relate to shallow submarine volcanism at the volcano. The on-going activity of Kick'em Jenny submarine volcano presents a range of hazards to the people in the Caribbean region, as has been stressed repeatedly to the regional governments by the Seismic Research Unit of the University of the West Indies.

VII. Summary of Education and Outreach

The cruise included an education/web specialist, Ms. Deborah Kay from NOAA and a teacher-at-sea, Brian Hawkins, from Oklahoma State University. They have already put together some preliminary information about the project that is posted on NOAA's website (http://oceanexplorer.noaa.gov/explorations/03kickem/welcome.html). In addition, Dr. John Shepherd has posted cruise information on the Kick'em Jenny website that is operated by the Seismic Research Unit of the University of West Indies (http://www.uwiseismic.com/SRU_Site01/KeJ/Cruise2003/kej2003cruise.html).

We have initiated an undergraduate educational component through the NSF-funded Summer Undergraduate Research Fellowship (SURFO) Program at the Graduate School of Oceanography, University of Rhode Island. Nobu Koch, a geology major from Pomona College in California has begun work looking at the ROV videotapes as part of a summer research project.

VIII. Post-cruise activities

A proposal to the National Science Foundation's Marine Geology and Geophysics program has been submitted (August 15, 2003). This proposal will seek funding to support shore-based analysis of data and samples collected during cruise RB-03-03.

IX. Inventory of Data Files collected-

See tables 2,3,4,5,6 on following pages.

TABLE 2 Summary of SEABEAM Datafiles created during RV Brown 03/03

Date	Filename	Data Type	Storage Location	Date	Filename	Data Type	Storage Location
11-Mar	sb200303111459.mb41	Seabeam	URI-GSO	13-Mar	sb200303131203.mb41	Seabeam	URI-GSO
11-Mar	sb200303111528.mb41	Seabeam	URI-GSO	13-Mar	sb200303131257.mb41	Seabeam	URI-GSO
11-Mar	sb200303111604.mb41	Seabeam	URI-GSO	13-Mar	sb200303131342.mb41	Seabeam	URI-GSO
11-Mar	sb200303111641.mb41	Seabeam	URI-GSO	13-Mar	sb200303131414.mb41	Seabeam	URI-GSO
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13-Mar	sb200303131105.mb41	Seabeam	URI-GSO	14-Mar	sb200303142134.mb41	Seabeam	URI-GSO

TABLE 2 cont. Summary of SEABEAM Datafiles created during RV Brown 03/03

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14-Mar	sb200303142345.mb41	Seabeam	URI-GSO	15-Mar	sb200303152023.mb41	Seabeam	URI-GSO
15-Mar	sb200303150121.mb41	Seabeam	URI-GSO	15-Mar	sb200303152036.mb41	Seabeam	URI-GSO
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15-Mar	sb200303151506.mb41	Seabeam	URI-GSO	19-Mar	sb200303191150.mb41	Seabeam	URI-GSO
15-Mar	sb200303151517.mb41	Seabeam	URI-GSO	19-Mar	sb200303191155.mb41	Seabeam	URI-GSO
15-Mar	sb200303151528.mb41	Seabeam	URI-GSO	19-Mar	sb200303191201.mb41	Seabeam	URI-GSO
15-Mar	sb200303151540.mb41	Seabeam	URI-GSO	19-Mar	sb200303191212.mb41	Seabeam	URI-GSO
15-Mar	sb200303151551.mb41	Seabeam	URI-GSO	19-Mar	sb200303191223.mb41	Seabeam	URI-GSO
15-Mar	sb200303151603.mb41	Seabeam	URI-GSO	19-Mar	sb200303191234.mb41	Seabeam	URI-GSO
15-Mar	sb200303151614.mb41	Seabeam	URI-GSO	19-Mar	sb200303191245.mb41	Seabeam	URI-GSO
15-Mar	sb200303151625.mb41	Seabeam	URI-GSO	19-Mar	sb200303191257.mb41	Seabeam	URI-GSO
15-Mar	sb200303151637.mb41	Seabeam	URI-GSO	19-Mar	sb200303191308.mb41	Seabeam	URI-GSO
15-Mar	sb200303151649.mb41	Seabeam	URI-GSO	19-Mar	sb200303192317.mb41	Seabeam	URI-GSO
15-Mar	sb200303151701.mb41	Seabeam	URI-GSO	19-Mar	sb200303192328.mb41	Seabeam	URI-GSO
15-Mar	sb200303151713.mb41	Seabeam	URI-GSO	19-Mar	sb200303192339.mb41	Seabeam	URI-GSO
15-Mar	sb200303151724.mb41	Seabeam	URI-GSO	19-Mar	sb200303192349.mb41	Seabeam	URI-GSO
15-Mar	sb200303151737.mb41	Seabeam	URI-GSO	20-Mar	sb200303200001.mb41	Seabeam	URI-GSO
15-Mar	sb200303151749.mb41	Seabeam	URI-GSO	20-Mar	sb200303200025.mb41	Seabeam	URI-GSO
15-Mar	sb200303151801.mb41	Seabeam	URI-GSO	20-Mar	sb200303200110.mb41	Seabeam	URI-GSO
15-Mar	sb200303151813.mb41	Seabeam	URI-GSO	20-Mar	sb200303200204.mb41	Seabeam	URI-GSO
15-Mar	sb200303151825.mb41	Seabeam	URI-GSO	20-Mar	sb200303200259.mb41	Seabeam	URI-GSO
15-Mar	sb200303151837.mb41	Seabeam	URI-GSO	20-Mar	sb200303200354.mb41	Seabeam	URI-GSO
15-Mar	sb200303151849.mb41	Seabeam	URI-GSO	20-Mar	sb200303200448.mb41	Seabeam	URI-GSO
15-Mar	sb200303151901.mb41	Seabeam	URI-GSO	20-Mar	sb200303200544.mb41	Seabeam	URI-GSO
15-Mar	sb200303151912.mb41	Seabeam	URI-GSO	20-Mar	sb200303200640.mb41	Seabeam	URI-GSO
15-Mar	sb200303151924.mb41	Seabeam	URI-GSO	20-Mar	sb200303200735.mb41	Seabeam	URI-GSO
15-Mar	sb200303151936.mb41	Seabeam	URI-GSO	20-Mar	sb200303200829.mb41	Seabeam	URI-GSO

TABLE 2 cont. Summary of SEABEAM Datafiles created during RV Brown 03/03

Date	Filename	Data Type	Storage Location
20-Mar	sb200303200924.mb41	Seabeam	URI-GSO
20-Mar	sb200303201019.mb41	Seabeam	URI-GSO
20-Mar	sb200303201107.mb41	Seabeam	URI-GSO
20-Mar	sb200303141111.mb41	Seabeam	URI-GSO
20-Mar	sb200303141121.mb41	Seabeam	URI-GSO
20-Mar	sb200303201131.mb41	Seabeam	URI-GSO
20-Mar	sb200303141132.mb41	Seabeam	URI-GSO
20-Mar	sb200303141142.mb41	Seabeam	URI-GSO
20-Mar	sb200303201152.mb41	Seabeam	URI-GSO
20-Mar	sb200303141153.mb41	Seabeam	URI-GSO
20-Mar	sb200303141203.mb41	Seabeam	URI-GSO
20-Mar	sb200303201211.mb41	Seabeam	URI-GSO
20-Mar	sb200303141214.mb41	Seabeam	URI-GSO
20-Mar	sb200303141225.mb41	Seabeam	URI-GSO
20-Mar	sb200303201230.mb41	Seabeam	URI-GSO
20-Mar	sb200303141235.mb41	Seabeam	URI-GSO
20-Mar	sb200303201251.mb41	Seabeam	URI-GSO
20-Mar	sb200303201350.mb41	Seabeam	URI-GSO
20-Mar	sb200303201404.mb41	Seabeam	URI-GSO
20-Mar	sb200303201414.mb41	Seabeam	URI-GSO
20-Mar	sb200303201425.mb41	Seabeam	URI-GSO
20-Mar	sb200303201436.mb41	Seabeam	URI-GSO
20-Mar	sb200303201446.mb41	Seabeam	URI-GSO
20-Mar	sb200303201457.mb41	Seabeam	URI-GSO
14-Mar	sb200303142051.mb41	Seabeam	URI-GSO
14-Mar	sb200303142104.mb41	Seabeam	URI-GSO
14-Mar	sb200303142118.mb41	Seabeam	URI-GSO
14-Mar	sb200303142134.mb41	Seabeam	URI-GSO
14-Mar	sb200303142156.mb41	Seabeam	URI-GSO
14-Mar	sb200303142312.mb41	Seabeam	URI-GSO
21-Mar	sb200303210837.mb41	Seabeam	URI-GSO
21-Mar	sb200303210936.mb41	Seabeam	URI-GSO
21-Mar	sb200303211019.mb41	Seabeam	URI-GSO
21-Mar	sb200303211034.mb41	Seabeam	URI-GSO
21-Mar	sb200303211131.mb41	Seabeam	URI-GSO
21-Mar	sb200303211229.mb41	Seabeam	URI-GSO
21-Mar	sb200303211325.mb41	Seabeam	URI-GSO
21-Mar	sb200303211421.mb41	Seabeam	URI-GSO
21-Mar	sb200303211516.mb41	Seabeam	URI-GSO
21-Mar	sb200303211609.mb41	Seabeam	URI-GSO

Table 3 Summary of ADCP Datafiles Collected During R/V Brown 03-03

Date	Filename	Data Type	Storage Location
13-Mar	PINGDATA.001	ADCP	URI-GSO
13-Mar	PINGDATA.002	ADCP	URI-GSO
14-Mar	PINGDATA.003	ADCP	URI-GSO
15-Mar	PINGDATA.004	ADCP	URI-GSO
15-Mar	PINGDATA.005	ADCP	URI-GSO
16-Mar	PINGDATA.006	ADCP	URI-GSO
17-Mar	PINGDATA.007	ADCP	URI-GSO
18-Mar	PINGDATA.008	ADCP	URI-GSO
18-Mar	PINGDATA.009	ADCP	URI-GSO
19-Mar	PINGDATA.010	ADCP	URI-GSO
20-Mar	PINGDATA.011	ADCP	URI-GSO
20-Mar	PINGDATA.012	ADCP	URI-GSO
21-Mar	PINGDATA.013	ADCP	URI-GSO
22-Mar	PINGDATA.014	ADCP	URI-GSO
22-Mar	PINGDATA.015	ADCP	URI-GSO

Table 4 Summary of CTD Datafiles Collected During R/V Brown 03-03

Date	Filename	Data Type	Storage Location
10-Mar	Jenny.con	CTD	URI-GSO
12-Mar	Jenny.dsf	CTD	URI-GSO
12-Mar	Jenny.dso	CTD	URI-GSO
12-Mar	KEJ01.BL	CTD	URI-GSO
12-Mar	KEJ.BTL	CTD	URI-GSO
12-Mar	KEJ01.CNV	CTD	URI-GSO
12-Mar	KEJ01.CON	CTD	URI-GSO
12-Mar	KEJ01.dat	CTD	URI-GSO
12-Mar	KEJ01.HDR	CTD	URI-GSO
12-Mar	KEJ01.ROS	CTD	URI-GSO
12-Mar	KEJ01SVP.CNV	CTD	URI-GSO
13-Mar	KEJ02.BL	CTD	URI-GSO
13-Mar	KEJ02.BTL	CTD	URI-GSO
13-Mar	KEJ02.CNV	CTD	URI-GSO
13-Mar	KEJ02.CON	CTD	URI-GSO
13-Mar	KEJ02.dat	CTD	URI-GSO
13-Mar	KEJ02.HDR	CTD	URI-GSO
13-Mar	KEJ02.ROS	CTD	URI-GSO

Table 5 Summary of Bathymetry 2000 Datafiles Collected During R/V Brown 03-

Date	Filename	Data Type	Storage Location
12-Mar	Y0312-01.DAT	Bathymetry 2000	URI-GSO
12-Mar	Y0312-02.DAT	Bathymetry 2000	URI-GSO
13-Mar	Y0313-01.DAT	Bathymetry 2000	URI-GSO
13-Mar	Y0313-02.DAT	Bathymetry 2000	URI-GSO
13-Mar	Y0313-03.DAT	Bathymetry 2000	URI-GSO
14-Mar	Y0314-01.DAT	Bathymetry 2000	URI-GSO
14-Mar	Y0314-02.DAT	Bathymetry 2000	URI-GSO
15-Mar	Y0315-01.DAT	Bathymetry 2000	URI-GSO
15-Mar	Y0315-02.DAT	Bathymetry 2000	URI-GSO
16-Mar	Y0316-01.DAT	Bathymetry 2000	URI-GSO
16-Mar	Y0316-02.DAT	Bathymetry 2000	URI-GSO
16-Mar	Y0316-03.DAT	Bathymetry 2000	URI-GSO
17-Mar	Y0317-01.DAT	Bathymetry 2000	URI-GSO
18-Mar	Y0318-01.DAT	Bathymetry 2000	URI-GSO
20-Mar	Y0320-01.DAT	Bathymetry 2000	URI-GSO

Table 6 Summary of Bathymetry 2002 Datafiles Collected During R/V Brown 03-

Date	Filename	Data Type	Storage Location
12-Mar	Y0312-01.DAT	Bathymetry 2002	URI-GSO
12-Mar	Y0312-02.DAT	Bathymetry 2002	URI-GSO
13-Mar	Y0313-01.DAT	Bathymetry 2002	URI-GSO
13-Mar	Y0313-02.DAT	Bathymetry 2002	URI-GSO
13-Mar	Y0313-03.DAT	Bathymetry 2002	URI-GSO
14-Mar	Y0314-01.DAT	Bathymetry 2002	URI-GSO
14-Mar	Y0314-02.DAT	Bathymetry 2002	URI-GSO
15-Mar	Y0315-01.DAT	Bathymetry 2002	URI-GSO
15-Mar	Y0315-02.DAT	Bathymetry 2002	URI-GSO
16-Mar	Y0316-01.DAT	Bathymetry 2002	URI-GSO
16-Mar	Y0316-02.DAT	Bathymetry 2002	URI-GSO
16-Mar	Y0316-03.DAT	Bathymetry 2002	URI-GSO
17-Mar	Y0317-01.DAT	Bathymetry 2002	URI-GSO
18-Mar	Y0318-01.DAT	Bathymetry 2002	URI-GSO
20-Mar	Y0320-01.DAT	Bathymetry 2002	URI-GSO