NOAA Office of Ocean Exploration Quick Look Report

Expedition Title: New Zealand American Submarine Ring of Fire 2007
(a.k.a. ROVARK)

Results (please check all disciplines in which this cruise collected data)	Details (please describe any novel discoveries in the discipline, answers such as "possible, awaiting data analysis" and "no apparent discoveries" are acceptable)
Bathymetric Mapping X Yes ☐ No	(please note total area mapped and technology employed, e.g. multibeam, side scan, etc.) (1) 3000+ km of trackline (>33,000 km$^{2)}$ with Simrad EM 120 multibeam bathymetry system (both bathymetry, backscatter and sidescan) (2) 161_km of trackline (~10km^{2}) with SM2000 high resolution multibeam bathymetry system mounted on ABE.
New Species Discovered ☐ Yes ☐ No	N/A
Bio-prospecting ☐ Yes ☐ No	(please note number, type, and potential use of new compounds discovered) N/A
Habitat Range Extended ☐ Yes ☐ No	(please note species discovered in new habitats and how far from previous range were they found0 N/A
Chemical Processes X Yes ☐ No	(please note new or unusual chemical properties such as methane seeps, hyper saline pools, vents, etc. observed) A secondary aim was to map and sample the water column of numerous deep (>3000 m) basins in the backarc using the GNS CTDO (conductivity-depth-temperature-optical) system. 10 basins were surveyed for hydrothermal emissions, including the very deep (>3500 m) Ngatoro Rift basin, with results pending after shore-based laboratory analysis.
Geologic Processes X Yes ☐ No	(please note new or unusual geologic processes that may impact scientific understanding of the region) Long term hydrothermal alteration of caldera wall weakens volcanic rocks, producing characteristic amphitheater-shaped depressions.
Physical Processes X Yes ☐ No	(please note new or unusual oceanographic processes that may impact scientific understanding of the region)
Sub/ROV/AUV Dives X Yes ☐ No	(please note name, type, and cumulative hours of bottom time for each platform / if available please provide average working time per dive for each platform / please note if new depth records were set) AUV dives with Autonomous Benthic Explorer (WHOI National Deep Submergence Facility. ABE spent >140 hours in the water, conducting scientific surveys >96 hours of that time (bottom time). 8 dives total (1 had early abort from leak).
New Technology X Yes ☐ No	(please note any new tools developed for or during this cruise, also identify first use of an existing technology in a new application) A pH sensor was used on ABE for the first time. It worked part of the time.
Maritime Cultural Heritage ☐ Yes X No	(please note discoveries impacting knowledge of the past, i.e. number and type of shipwrecks) N/A
Outreach X Yes ☐ No	(please describe outreach channels, e.g. web, port call, etc., used in this project) New Zealand independent documentary film maker on board for part of expedition Ocean Exploration website: http://oceanexplorer.noaa.gov/explorations/07fire/
Students Involved X Yes ☐ No	(please note the number and level of students on the expedition) None.
Multidisciplinary X Yes ☐ No	(please identify the formal disciplines represented in the science party) Marine Geology, Marine Geophysics, Chemistry, Noble gas tracers, Economic Geology, Volcanology, Education, Geochemistry
Exploration of New Regions X Yes ☐ No	(please note if the area of operations had been previously studied, if so please check no and approximate as slight, moderate or significant, the level of knowledge before the cruise)

	Moderate

NOAA Office of Ocean Exploration
FY 2007 Expeditions

Quick Look Report Required Elements

Project title: New Zealand American Submarine Ring of Fire 2007 (NZASRoF'07)
*ROVARK is official GEOMAR cruise designation in

Principal Investigator(s) and institution: Robert W. Embley (NOAA/PMEL), Edward Baker (NOAA/PMEL), Joseph Resing (JISAO/U. Washington/NOAA/PMEL), Cornel de Ronde (GNS Science), Bryan Davy (GNS Science), John E. Lupton (NOAA/PMEL), Kevin Faure (GNS Science)

Expedition title: New Zealand American Submarine Ring of Fire 2007 (named ROVARK by GEOMAR)

Expedition dates and itinerary: July 27 to August 16, Auckland to Auckland, New Zealand

Chief Scientist(s) and institution: Dr. Colin Devey (IFM-GEOMAR - Germany); Dr. Cornel de Ronde (GNS Science, New Zealand); Dr. Robert W. Embley, NOAA/PMEL; Dr. Dana Yoerger (WHOI) – ABE Team Leader.

Co-sponsors / partners / participating organizations: (a table of names and affiliations). Note: Does not include names of personnel on board involved in engineering testing of Quest 7 remotely operated vehicle.

Name	Nationality	Affiliation
Baker, Edward	USA	NOAA/PMEL
Billings, Andrew	USA	Woods Hole Oceanographic Inst.
Duester, Al	USA	Woods Hole Oceanographic Inst.
Davy, Bryan	New Zealand	GNS Science
de Ronde, Cornel	New Zealand	GNS Science
Duester, Al	USA	Woods Hole Oceanographic Inst.
Embley, Robert W.	USA	NOAA/PMEL
Leybourne, Matthew	New Zealand	GNS Science
Fauve, Kevin	New Zealand	GNS Science
Greene, Ron	USA	CIMRS/ Oregon St. U./NOAA/PMEL
Leybourne, Matthew	New Zealand	GNS Science
Merle, Susan G.	USA	CIMRS/ Oregon St. U./ NOAA/PMEL
Resing, Joseph	USA	JISAO/U. Washington/NOAA/PMEL
Walker, Sharon	USA	NOAA/PMEL
Yoerger, Dana	USA	Woods Hole Oceanographic Inst.

Vessel Identification: R/V SONNE

Primary Equipment: (1) Autonomous Benthic Explorer (ABE) dives; (2) Simrad EM120 mapping system, ADCP, magnetometer; (3) CTD rosette; (4) Remotely operated vehicle Quest 7 owned by GEOMAR (Note: Engineering test dives with this system were also conducted on cruise).

Geographic area of operations: Kermadec Arc, western Pacific; CTDABE dives all at Brothers Volcano. Multibeam and CTD surveys also in Havre Trough to west of Kermadec arc (see location map below).

Summary of Expedition Objectives: (1) Detailed mapping of seafloor, water column (CTDO) and magnetic field at Brothers; (2) Regional mapping and CTD) surveys of Havre Trough (Kermadec back-arc area).

Milestones Achieved: (This section of the report should amplify the information provided in the official OE cover sheet summary of results. This section should elaborate on key findings)

(1) The primary product of the expedition is the first high-resolution holistic map of an active submarine arc volcano. Multiple sensor suites on ABE produced co-registered layers of bathymetry, total magnetic field, water temperature and conductivity, water turbidity, electrical redox potential (Eh), and (on some dives) pH. The success of this approach is underscored by the robust correlations made between the crustal magnetization, submarine geomorphology and hydrothermal indicators in Brothers caldera
(2) The first systematic survey for hydrothermal anomalies in the Havre Trough lying west of the Kermadec arc was conducted while ABE was surveying the seafloor and during transits to and from Auckland (Map. Results are pending for the shore side analyses of noble gases of the water samples (a key hydrothermal indicator) taken on the CTDO casts.

Sample log entries: N/A

Summary of Digital Data Collected:
(1) CTD (raw data) 9 MB.
(2) 1574 CTD subsamples collected. These include: helium isotopes, methane, pH, total carbon dioxide, total dissolvable trace metals, dissolved trace metals, particulate bulk chemistry, particle morphology and type.
(3) Multibeam (Simrad EM120) 1.7 GB . 383 data files.
(4) ABE data files 1.2 GB. Data types included: SM2000 high resolution bathymetry 200kHz multibeam sonar; 3-component Develco fluxgate magnetometer; SeaBird 9/11+ CTD systems, SeaPoint optical backscatter sensor (OBS); Eh sensor

Summary of outreach and educational activities:

Ocean Exploration website includes 6 pre-cruise background pieces provided pre-cruise and 9 at-sea web logs. Ask and Explorer questions were also answered while at sea. Videos provided prior to the expedition included a podcast and several bathymetry fly-throughs. An additional fly-through over the high-resolution ABE data was sent to the website from Auckland after the expedition. The expedition was featured in the New Zealand media and a short documentary was made by Mr. Michael Hacking that will be produced by Catalyst TV (http://www.abc.net.au/catalyst/).

Thoughts for the Future:

Island arc submarine volcanism is still a frontier area for ocean exploration:

We have made significant progress in exploring portions of the two largest intraoceanic arcs of the western Pacific under OE sponsorship since 2003. However, there is still much to do in several areas:

(1) Exploration at finer scales: This study shows the value of a thorough exploration of a hydrothermally active submarine volcano which is predicated on mapping at a scale that will resolve features that can be recognized within the light pool of a submersible or ROV. At the same time, areas of active and fossil venting can be mapped out with water column and geophysical sensors. The only efficient way to do this is by using an autonomous vehicle. Of particular importance are sites with large calderas (>2 km diameter) that contain a long history of hydrothermal and volcanic activity in a geologically complex setting. Imagery by AUV's and ROVs from such surveys will contribute valuable data to the developing a global perspective of seamounts as centers of biodiversity and productivity.

(2) Basic Exploration: We have made preliminary explorations of 12 hydrothermally active volcanoes in the Mariana Arc and of another 8 volcanoes on the Kermadec Arc. There are still at least 30 more unexplored active sites on the Mariana, Kermadec, and Tonga Arcs. In addition, there are also a number of smaller intraoceanic arcs in the Pacific and Atlantic oceans that have not even been mapped with modern multibeam systems. Many of the intraoceanic arcs have backarc spreading centers or rift zones where hydrothermal activity is likely but exploration is almost nonexistent. For example, the Mariana backarc spreading center and the northern Lau Basin lack systematic hydrothermal surveys.

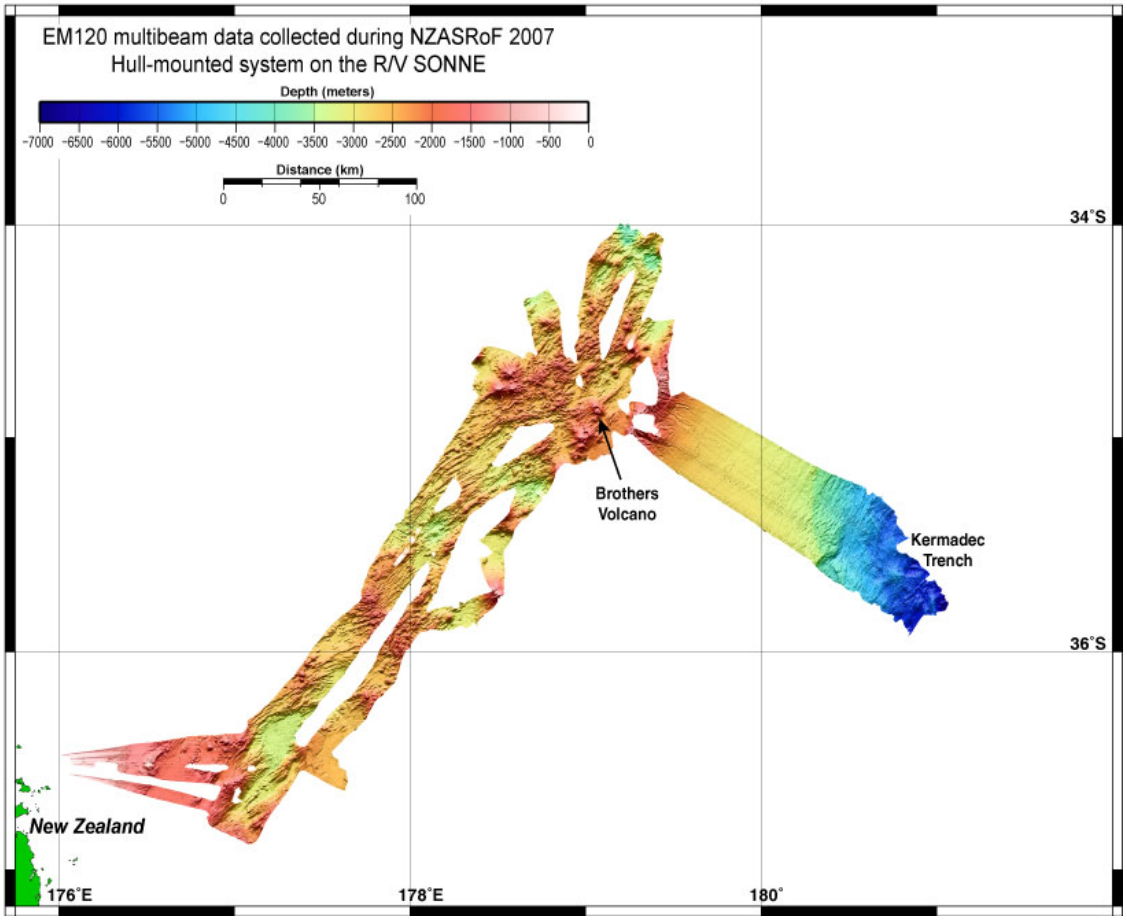
(3) Synoptic and Temporal Exploration: The unique nature of some of the active sites discovered during this and previous Submarine Ring of Fire expeditions will require additional visits and some new tools and techniques to study the volcanic and hydrothermal processes. In particular, the ongoing eruption at NWRota-1 provides a unique opportunity to explore linkages between the solid earth, the oceans and its biotic systems. Synoptic studies using combinations of fixed moorings on the

seafloor and water column, an ROV and an AUV could provide new insights into how a submarine volcano works. Seismometers and/or hydrophones could link seismicity and volcanic tremor to changes in volcanic output from the summit observed by an ROV, and to dispersal into the ocean recorded by fixed moorings with turbidity and chemical sensors. AUV surveys could provide a broader synoptic view of changes in volcanic output around the entire volcano, remapping the summit area at frequent intervals to document growth and failure of the volcanic cone.

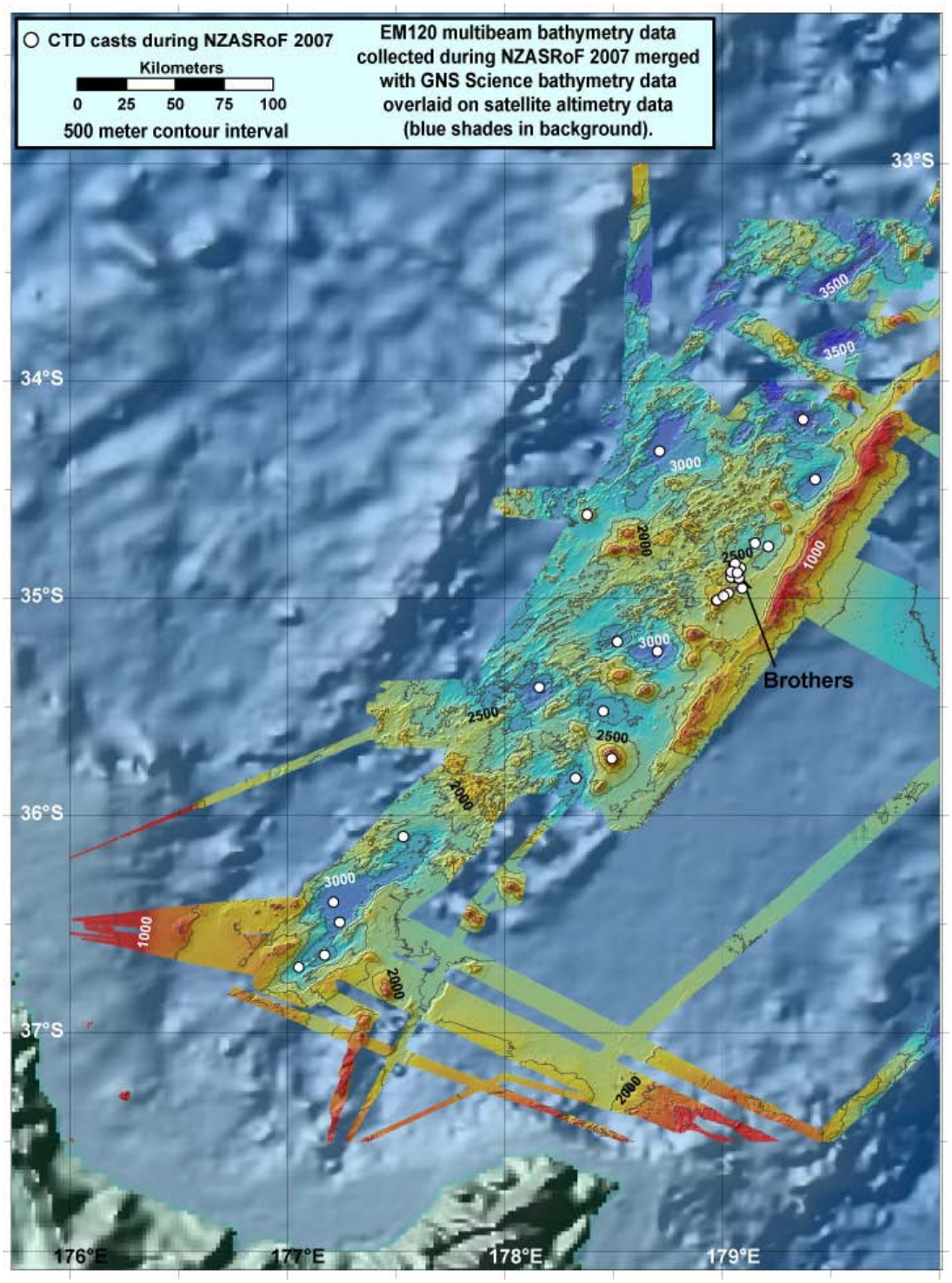
Summary of Expedition Operations: See cruise summary map and Tables attached here.

Notes:

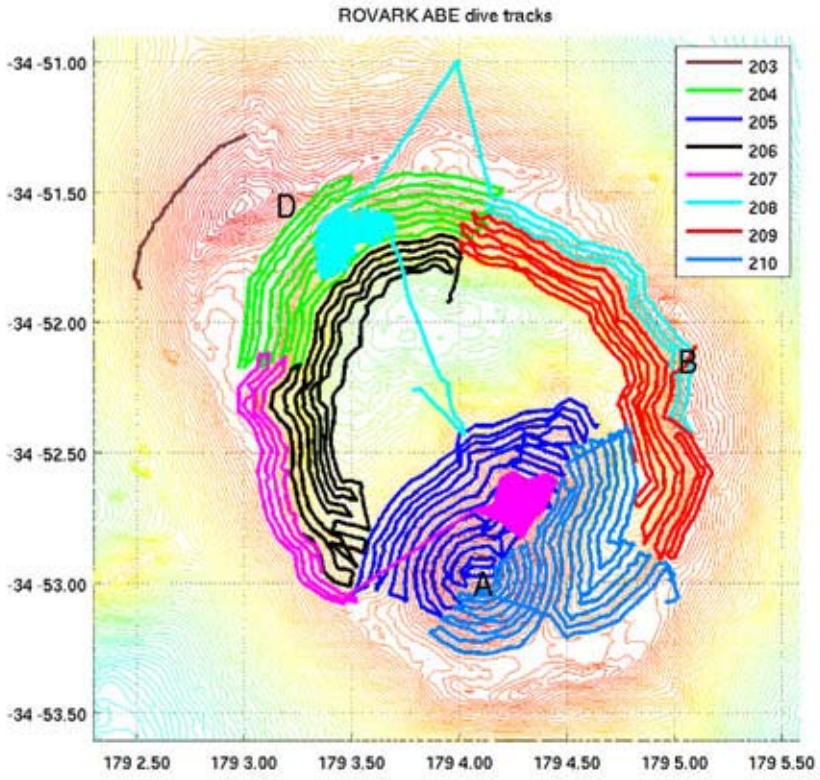
1) SONNE - The R/V SONNE was an excellent vessel to conduct the operations. The ship's scientific systems performed well with very little downtime.
2)ABE - The first dive (203) was aborted due to a seawater leak. Fortunately, very little serious damage was done and the ABE performed well on most of the dives (204-210). There was a partial failure on Dive 205 due to a seawater short in the Eh sensor. Only the seafloor mapping systems (Imagenex and SM2000 multibeam) and the CTD recorded data.
3) CTD – The CTD/Rosette system worked well throughout the expedition.
4) Remotely Operated Vehicle – This expedition also served as a test cruise for the new GEOMAR Quest 7 remotely operated vehicle.



Map 1: Multibeam data (EM120 system) collected during New Zealand American SRoF (ROVARK) expedition on R/V SONNE.



Map 2: Locations of CTD stations made during New Zealand American SRoF (ROVARK) expedition on R/V SONNE.



Map 3: ABE dive tracks over Brothers volcano made during New Zealand American Submarine Ring of Fire 07 (a.k.a. ROVARK) expedition.

Table I: Operations Log Submarine Ring of Fire 07 (ROVARK)

New Zealand-American Submarine Ring of Fire 2007 (ROVARK) July 29 - August 16, 2007 (R/V SONNE)

UTC time is 12 hours earlier than Auckland local time

Color scheme: general comments (black); EM120 surveys (green); CTD casts (brown); ABE dives (blue); ROV dives (red)

Date (Local)	Time (Local)	Date (UTC)	Time (UTC)	Event	Comments
29-Jul	0:00	28-Jul	12:00	Depart Auckland Steaming NW in gale. Collecting EM120 multibeam data (Rovark-001 survey). Seas are bad so the data quality is	
			16:00	marginal.	20' seas; speed ~6 kn
30-Jul	6:00	29-Jul	18:00	Seas calming down	Speed ~10 kn
30-Jul	14:25	30-Jul	2:25	CTD V07A-01 Cast 1 starts. Brothers cone. Started at summit then moved to NE satellite cone and continued.	34 53.014'S 179 4.038'E
30-Jul	~15:00	30-Jul	3:00	ROV wire testing	
	16:52	30-Jul	4:52	CTD V07A-01 Cast 1 ends	34 52.765'S 179 4.273'E
30-Jul	18:21	30-Jul	6:21	ABE dive #203 begins. NW Wall site. ABE dive 203 aborted - leaking connectors and transponder problems.	34 51.971'S 179 3.007'E
30-Jul	22:46	30-Jul	10:46	ABE dive #203 ends	34 51.519'S 179 3.547'E
30-Jul	23:00	30-Jul	11:00	Head off to trench to test the ROV wire in deep water. Start logging EM120 multibeam data (Rovark-002 survey).	34 51.519'S 179 3.547'E
31-Jul	10:15	30-Jul	20:15	Arrive at trench site. Stop logging EM120 multibeam. ROV deep wire test began.	
				Winch level wind started eating itself. Deep wire test abandoned. Spent 13+ hours spooling the cable back on the winch. The sled feeding the cable was not up to the task.	
31-Jul	21:00	31-Jul	9:00	Finished winding cable back on the drum.	
31-Jul	21:15	31-Jul	9:15	Start EM120 multibeam survey -Kermadec trench area and back to Brothers (Rovark-003).	35 48.47'S 179 4.73'W
				While at trench site realized that the ABE nose cone was corroded and time was needed to work on that.	
1-Aug	8:30	31-Jul	20:30	Stop logging EM120 multibeam for CTD at Basin H	34 27.352'S 179 25.716'E
1-Aug	9:01	31-Jul	21:01	CTD V07A-02 cast 2 starts. Basin H	34 27.352'S 179 25.716'E
1-Aug	11:47	31-Jul	23:47	CTD V07A-02 cast 2 ends	
1-Aug	12:10	1-Aug	0:10	Start logging EM120 multibeam (Rovark-004)	34 28.26'S 179 24.9'E
1-Aug	13:58	1-Aug	1:58	Stop logging EM120 multibeam for CTD at Basin G2	34 45.000'S 179 9.150'E
1-Aug	14:02	1-Aug	2:02	CTD V07A-03 cast 3 starts. Basin G2	34 45.000'S 179 9.150'E
1-Aug	16:41	1-Aug	4:41	CTD V07A-03 cast 3 ends	
1-Aug	16:46	1-Aug	4:46	Start logging EM120 multibeam. Survey to Basin G1	34 45.01'S 179 9.13'E
1-Aug	17:30	1-Aug	5:30	Stop logging EM120 multibeam for CTD at Basin G1	34 45.87'S 179 12.76'E
1-Aug	17:37	1-Aug	5:37	CTD V07A-04 cast 4 starts. Basin G1.	34 45.87'S 179 12.76'E
1-Aug	19:53	1-Aug	7:53	CTD V07A-04 cast 4 ends	
1-Aug	21:15	1-Aug	9:15	Begin Magnetometer survey at Brothers	

1-Aug	21:31	1-Aug	9:31	Start logging EM120 multibeam during magnetometer survey at Brothers.	
2-Aug	1:51	1-Aug	13:51	End magnetometer survey	
2-Aug	1:55	1-Aug	13:55	Stop logging EM120 multibeam. End of survey Rovark-004.	34 50.49'S 179 6.89'E
2-Aug	2:30	1-Aug	14:30	Begin USBL calibration for ROV navigation.	
2-Aug	6:00	1-Aug	18:00	End USBL calibration. Serial port problems.	
2-Aug	9:13	1-Aug	21:13	ABE dive # 204 begins. NW Wall site - inside caldera portion.	34 51.971'S 179 3.006'E
2-Aug	16:55	2-Aug	4:55	CTD V07A-05 cast 5 starts at Brothers South Rift (Dziak seismic zone).	34 54.43'S 179 4.03'E
2-Aug	1840	2-Aug		CTD V07A-05 cast 5 ends.	
2-Aug	19:50	2-Aug	7:50	CTD V07A-06 cast 6 starts at Basin F.	34 57.49'S 179 5.64'E
2-Aug	21:36	2-Aug	9:36	CTD V07A-06 cast 6 ends.	
2-Aug	22:37	2-Aug	10:37	CTD V07A-07 cast 7 starts at Brothers NW caldera wall.	3451.75'S 179 3.5'E
3-Aug	0:06	2-Aug	12:06	CTD V07A-07 cast 7 ends.	
3-Aug	2:09	2-Aug	14:09	ABE Dive 204 ends.	34 51.727'S 179 3.965'E
3-Aug	3:09	2-Aug	15:09	CTD T07A-01 cast 8 starts. Tow over Brothers cone (NE to SW).	34 51.874'S 179 5.196'E
3-Aug	3:20	2-Aug	15:20	Working on ROV deployment adjustments	
3-Aug	4:00	2-Aug	16:00	Adjustment complete.	
3-Aug	7:17	2-Aug	19:17	CTD T07A-01 cast 8 ends.	34 54.29'S 179 2.518'E
3-Aug	9:03	2-Aug	21:03	CTD T07A-02 cast 9 starts. Tow over Brothers caldera (NW to SE over NW caldera wall site and cone)	34 51.286'S 179 3.288'E
3-Aug	1415	3-Aug	2:05	CTD T07A-02 cast 9 ends.	34 54.54'S 179 4.76'E
3-Aug	15:58	3-Aug	3:58	ABE dive #205 begins. NW side of main and satellite cones.	34 55.500'S 179 0.000'E
3-Aug	19:55	3-Aug	7:55	Start logging EM120 multibeam on transit to Basin I.	34 42.72'S 178 54.89'E
3-Aug	22:12	3-Aug	10:12	Stop logging EM120 multibeam.	
3-Aug	22:22	3-Aug	10:22	CTD V07A-08 cast 10 starts at Basin I.	34 19.65'S 178 42.79'E
4-Aug	0:58	3-Aug	12:58	CTD V07A-08 cast 10 ends.	
4-Aug	1:13	3-Aug	13:13	Start logging EM120 multibeam on transit back to Brothers.	34 24.015'S 178 43.861'E
4-Aug	5:53	3-Aug	17:53	Stop logging EM120 multibeam. Arrive back at Brothers.	
4-Aug	7:00	3-Aug	19:00	Quest 7 ROV in water at Brothers.	
4-Aug	15:00	4-Aug	3:00	Quest 7 ROV on board	
4-Aug	17:05	4-Aug	5:05	ABE Dive #205 ends	34 52.378'S 179 4.769'E
4-Aug	17:31	4-Aug	5:31	Start logging EM120 multibeam (Rovark_007) to map large edifice on satellite data then do CTD on backarc cone. Towing surface magnetometer at same time - 10 kts max.	34 52.02'S 179 3.59'E
4-Aug	20:20	4-Aug	8:20	Motion sensor error on EM120. Start another survey number (Rovark_008).	34 42.16'S 178 31.29'E
4-Aug	21:31	4-Aug	9:31	Stop logging EM120 multibeam.	34 37.19'S 178 22.96'E
4-Aug	21:35	4-Aug	9:35	CTD V07A-09 cast 11 starts at Volcano "X" in backarc.	34 37.13'S 178 22.89'E
4-Aug	22:45	4-Aug	10:45	CTD V07A-09 cast 11 ends.	
4-Aug	23:06	4-Aug	11:06	Start logging EM120 multibeam survey (Rovark_008 line 4) back to Brothers. Towing surface magnetometer at same time - 10 kts max.	34 37.24'S 178 23.56'E
5-Aug	5:40	4-Aug	17:40	Stop logging multibeam and magnetics. Arrive at Brothers for ABE Dive 2-06	

5-Aug	7:02	4-Aug	19:02	ABE dive #206 begins. Finished NW wall; on to west wall and part of caldera floor.	34 51.930’S 179 3.940’E
5-Aug	??08:00	4-Aug	??20:00	Start logging EM120 multibeam (Rovark_008 line 19) during transit to Basin E1.	
5-Aug	19:00	5-Aug	7:00	Stop logging EM120 multibeam. Aborted CTD cast up north du to time constraints.	34 50.95'S 179 4.37'E
5-Aug	22:32	5-Aug	10:32	ABE Dive #206 ends	34 52.576’S 179 3.298’E
5-Aug	22:48	5-Aug	10:48	Start logging EM120 multibeam on transit to Auckland (Rovark_008 line 37). Will stop for CTDs at basins along the way.	34 52.64'S 179 3.37'E
6-Aug	1:22	5-Aug	13:22	Stop logging EM120 multibeam for CTD.	35 14.49'S 178 42.84'E
6-Aug	1:39	5-Aug	13:39	CTD V07A-10 cast 12 starts at Basin E1.	35 14.769'S 178 42.259'E
6-Aug	4:26	5-Aug	16:26	CTD V07A-10 cast 12 ends.	
6-Aug	4:37	5-Aug	16:37	Start logging EM120 multibeam while continuing transit to Auckland.	
6-Aug	6:34	5-Aug	18:34	Stop logging EM120 multibeam for CTD.	35 31.27' S 178 27.43'E
6-Aug	6:37	5-Aug	18:37	CTD V07A-11 cast 13 starts at Basin C.	35 31.294'S 178 27.37'E
6-Aug	8:45		20:45	CTD V07A-11 cast 13 ends.	
6-Aug	9:02	5-Aug	21:02	Start logging EM120 multibeam (Rovark_009? line3). Continuing transit to Auckland with stops for CTDs.	35 33.33'S 178 27.68'E
6-Aug	10:03	5-Aug	22:03	Stop logging EM120 multibeam for CTD.	35 44.327'S 178 29.869'E
6-Aug	10:18	5-Aug	22:18	CTD V07A-12 cast 14 starts at Rumble III volcano.	35 44.4'S 178 29.67'E
6-Aug	10:52	5-Aug	22:52	CTD V07A-12 cast 14 ends.	
6-Aug	11:00	5-Aug	23:00	Start logging EM120 multibeam from Rumble III to Basin B.	35 44.4'S 178 29.67'E
6-Aug	11:53	5-Aug	23:53	Stop logging EM120 multibeam for CTD.	
6-Aug	12:08	6-Aug	0:08	CTD V07A-13 cast 15 starts at Basin B.	35 49.78'S 178 19.65'E
6-Aug	14:28	6-Aug	2:28	CTD V07A-13 cast 15 ends.	
6-Aug	14:40	6-Aug	2:40	Start logging EM120 multibeam (Rovark_009 line 12). Continuing with transit to Auckland. Not tracking bottom due to wrong minimum depth parameter.	35 49.78'S 178 19.65'E
6-Aug	14:48	6-Aug	2:48	Reset multibeam logging (Rovark_009 line 13) Colleting data during transit.	35 50.09'S 178 17.56'E
7-Aug	5:08	6-Aug	17:08	Stop logging EM120 multibeam (Rovark_009 line 43). At 200 meter limit for data collection.	36 29.758'S 176 3.794'E
7-Aug	~08:00	6-Aug	~20:00	Arrive at Auckland harbor for personnel transfer.	
7-Aug	~1700	7-Aug	~0500	Leave Auckland after personnel transfer.	
7-Aug	21:26	7-Aug	9:26	Start logging EM120 multibeam (Rovark_010 line 1) during transit back to Brothers.	36 31.07'S 176 4.90'E
8-Aug	1:48	7-Aug	13:48	Stop logging EM120 multibeam for CTD.	
8-Aug	2:02	7-Aug	14:02	CTD V07A-14 cast 16 starts at Basin A1.	36 38.612'S 177 10.477'E
8-Aug	3:56	7-Aug	15:56	CTD V07A-14 cast 16 ends.	
8-Aug	4:03	7-Aug	16:03	Start logging EM120 multibeam (Rovark_010 line 10).	36 36.64'S 177 10.365'E
8-Aug	4:47	7-Aug	16:47	Stop logging EM120 multibeam for CTD.	36 41.862'S 177 3.52'E
8-Aug	4:54	7-Aug	16:54	CTD V07A-15 cast 17 starts at Basin A2.	36 41.928'S 177 3.410'E
8-Aug	6:49	7-Aug	18:49	CTD V07A-15 cast 17 ends.	

8-Aug	7:04	7-Aug	19:04	Start logging EM120 multibeam (Rovark_010 line 13).	
8-Aug	8:26	7-Aug	20:26	Stop loggingEM120 multibeam for CTD.	36 29.413'S 177 14.664'E
8-Aug	8:29	7-Aug	20:29	CTD V07A-16 cast 18 starts at Basin A3.	36 29.55'S 177 14.642'E
8-Aug	10:32	7-Aug	22:32	CTD V07A-16 cast 18 ends.	
8-Aug	~10:40	7-Aug	~22:40	Start logging EM120 multibeam (Rovark line?)	36 28.924'S 177 14.49'E
8-Aug	11:20	7-Aug	23:20	Stop logging EM120 multibeam for CTD.	36 23.75'S 177 12.94'E
8-Aug	11:20	7-Aug	23:20	CTD V07A-17 cast 19 starts at Basin A4.	36 24.01'S 177 13.03'E
8-Aug	13:28	8-Aug	1:28	CTD V07A-17 cast 19 ends.	
8-Aug	13:36	8-Aug	1:36	Start logging EM120 multibeam (Rovark_011 line 5).	36 24.24'S 177 12.93'E
8-Aug	15:54	8-Aug	3:54	CTD V07A-18 cast 20 starts at Basin A5.	36 5.91'S 177 32.18'E
8-Aug	16:01	8-Aug	4:01	Stop logging EM120 multibeam during CTD.	
8-Aug	17:39	8-Aug	5:39	CTD V07A-18 cast 20 ends.	
8-Aug	17:45	8-Aug	5:45	Start logging EM120 multibeam (Rovark_011 line 11).	36 5.93'S 177 32.27'E
8-Aug	22:09	8-Aug	10:09	Stop logging EM120 multibeam for CTD.	35 24.72'S 178 9.67'E
8-Aug	22:14	8-Aug	10:14	CTD V07A-19 cast 21 starts at Basin D.	35 24.8'S 178 9.64'E
9-Aug	0:21	8-Aug	12:21	CTD V07A-19 cast 21ends.	
9-Aug	0:28	8-Aug	12:28	Start logging EM120 multibeam (Rovark_011 line 22).	35 24.70'S 178 9.57'E
9-Aug	5:05	8-Aug	17:05	Stop logging EM120 multibeam. Back at Brothers	
9-Aug	5:52	8-Aug	17:52	ABE Dive #207 begins. Bathy/magnetics surveys of west wall and temperature survey over satellite cone.	34 52.885'S 179 3.349'E
9-Aug	??	8-Aug	??	ROV navigation calibration survey.	
9-Aug	10:20	8-Aug	22:20	Start logging EM120 multibeam (Rovark_012 line 1). Heading to last basin south for CTD.	
9-Aug	13:50	9-Aug	1:50	Stop logging EM120 multibeam for CTD.	35 12.09'S 178 31.45'E
9-Aug	13:55	9-Aug	1:55	CTD V07A-20 cast 22 starts at Basin E2.	35 12.16'S 178 31.28'E
9-Aug	16:00	9-Aug	4:00	CTD V07A-20 cast 22 ends.	
9-Aug	??16:15	9-Aug	??04:15	Start logging EM120 multibeam (Rovark_012 line 10) filling in data gaps to the west and north heading back to Brothers.	
9-Aug	20:05	9-Aug	8:05	Stop logging EM120 multibeam. Turned off because of a frequency interference with ABE.	34 50.47'S 178 45.615'E
10-Aug	0:05	9-Aug	12:05	ABE Dive #207 ends.	34 52.774'S 179 4.461'E
10-Aug	0:27	9-Aug	12:27	Surface-towed magnetometer in the water.	
10-Aug	0:33	9-Aug	12:33	Start surface-towed magnetometer and EM120 multibeam surveys from Brothers to Healy and back to Brothers.	34 53.28'S 179 5.00E
10-Aug	7:00	9-Aug	19:00	End magnetometer survey # 2. Stopped logging EM120 multibeam. Back at Brothers.	35 55.602'S 179 1.526'E
10-Aug	8:55	9-Aug	20:55	Sitting at Brothers waiting for ROV deployment and for ABE to recharge its batteries.	
10-Aug	~10:30	9-Aug	~22:30	QUEST 7 ROV in water at Brothers.	
10-Aug	13:35	10-Aug	1:35	ABE Dive #208 begins. Caldera floor, northwest and eastern walls.	34 55.500'S 179 0.000'E
10-Aug	19:00	10-Aug	7:00	QUEST 7 ROV on board.	

10-Aug	20:12	10-Aug	8:12	Start logging EM120 multibeam (Rovark_013 line 1) from Brothers to Basin J.	34 40.73'S 179 2.17'E
11-Aug	0:53	10-Aug	12:53	Stop logging EM120 multibeam for CTD.	
11-Aug	0:57	10-Aug	12:57	CTD V07A-21 cast 23 starts at Basin J.	34 10.846'S 179 22.426'E
11-Aug	3:16	10-Aug	15:16	CTD V07A-21 cast 23 ends.	
11-Aug	3:30	10-Aug	15:30	Start logging EM120 multibeam (Rovark_013 line 11). Heading back to Brothers. Logging this for backscatter data.	34 10.792'S 179 22.526'E
11-Aug	17:03	10-Aug	19:03	Stop logging EM120 multibeam.	
11-Aug	9:34	10-Aug	21:34	ABE Dive #208 ends.	34 52.379'S 179 5.052'E
11-Aug	11:00	10-Aug	23:00	Quest 7 ROV in the water at Brothers caldera north wall.	
11-Aug	19:05	11-Aug	7:05	QUEST 7 ROV on board.	
11-Aug	19:57	11-Aug	7:57	CTD V07A-22 cast 24 starts at Brothers caldera west wall.	34 52.17'S 179 3.13'E
11-Aug	21:12	11-Aug	9:12	CTD V07A-22 cast 24 ends.	
11-Aug	21:38	11-Aug	9:38	ABE Dive #209 starts. Survey Brothers east wall. Did not do EM120 survey to Healy because have the data already.	34 52.255'S 179 5.155'E
12-Aug	0:46	11-Aug	12:46	CTD T07A-03 cast 25 starts. Tow through Healy caldera and over cone (NE to SW)	34 58.801'S; 179 1.788'E
12-Aug	6:04	11-Aug	18:04	CTD T07A-03 cast 25 ends.	35 0.833S; 178 58.574'E
				Back to Brothers Caldera - Not Logging EM120 multibeam.	
12-Aug	7:42	11-Aug	19:42	CTD T07A-04 cast 26 starts. Tow at Brothers - NE to SW over N flank and over shelf at top of caldera wall ("Tiki Bar")	34 50.630'S; 179 3.653'E
12-Aug	11:30	11-Aug	23:30	CTD T07A-04 cast 26 ends.	34 52.877'S; 179 2.647'E
12-Aug	14:08	12-Aug	2:08	ABE Dive #209 ends.	34 52.358'S 179 4.934'E
12-Aug	~14:30	12-Aug	~02:30	Start transponder recovery at Brothers.	
12-Aug	17:30	12-Aug	5:30	Transponder recovery complete.	
12-Aug	18:22	12-Aug	6:22	CTD V07A-23 cast 27 starts at Brothers south of cone summits (for nubile methane).	34 53.08'S 179 4.33'E
12-Aug	19:49	12-Aug	7:49	CTD V07A-23 cast 27 ends.	
				Transit to Healy Volcano. No EM120 multibeam survey.	
12-Aug	21:18	12-Aug	9:18	CTD V07A-24 cast 28 starts at Healy cone.	35 0.69'S 178 58.76'E
12-Aug	22:25	12-Aug	10:25	CTD V07A-24 cast 28 ends.	
12-Aug	23:50	12-Aug	11:50	CTD V07A-25 cast 29 starts at Healy caldera.	34 59.617'S 179 0.465'E
13-Aug	1:22	12-Aug	13:22	CTD V07A-25 cast 29 ends.	
13-Aug	1:30	12-Aug	13:30	Transit back to Brothers for ABE dive.	
13-Aug	4:00	12-Aug	16:00	ABE Dive #210 starts. Southern side of main and satellite cones.	34 53.066'S 179 4.925'E
13-Aug	6:00	12-Aug	~18:00	Begin transit to trench for winch test.	
13-Aug	6:53	12-Aug	18:53	Start logging EM120 multibeam ~10 nm from Brothers to prevent crosstalk with LBL ABE transponders (Rovark_015 line 1).	34 52.56'S 179 15.00'E
13-Aug	14:15	13-Aug	2:15	Stop logging EM120 multibeam at the trench cable test site (~7000 meters water depth).	35 30.59'S 179 14.52'W

13-Aug	18:30	13-Aug	6:30	Completed testing the cable at the trench site after 4+ hours.	
13-Aug	19:09	13-Aug	7:09	Start logging EM120 multibeam on transit from trench site to Brothers (Rovark_016 line 17).	35 30.73'S 179 14.93'W
14-Aug	1:45	13-Aug	13:45	Stop logging EM120 multibeam ~10nm from Brothers to prevent interference with ABE LBL.	34 50.23'S 179 30.41'E
14-Aug	5:49	13-Aug	17:49	ABE Dive #210 ends.	34 53.026'S 179 4.777'E
14-Aug	10:40	13-Aug	22:40	Start logging EM120 multibeam for survey back to Auckland (Rovark_017 line 1).	34 49.83'S 178 51.8'E
15-Aug	11:00	14-Aug	23:00	End of EM120 multibeam survey Rovark_018.	~36 30.9'S 177 29.04'E
15-Aug	11:05	14-Aug	23:05	Heading east at less than 1knot for ROV ops on the back deck.	
15-Aug	18:43	15-Aug	6:43	Heading west back toward Auckland at full speed. Not sure when we turned around.	36 31.8'E 177 28.3'W
16-Aug	~08:00	15-Aug	20:00	Arrived in Auckland harbor. End of cruise.	

Table II: Data Summary for New Zealand Amercian Submarine Ring of Fire 2007

Data Type	Total Number	Amount (MB)	Amount km^2	Amount Km. Track	Amount Hours
ABE Dives	8	1200	~10	161	140
CTD Niskins (# bottles tripped)	431	n/a	n/a	n/a	n/a
CTD Lowerings	29	n/a	n/a	n/a	67
CTD seawater subsamples (from niskins)	1574	n/a	n/a	n/a	n/a
CTD (Sensor data)	temperature, conductivity, pressure, optical backscatter, methane, pH, oxidation reduction potential, altitude	n/a (see raw and processed data amounts below)	n/a	n/a	n/a
CTD raw data	n/a	9	n/a	n/a	n/a
CTD processed data	n/a	130	n/a	n/a	n/a
Simrad EM120 bathymetry	383 raw data files	1764	33,000+	3000+	
Ship data (navigation, meteorological, ADCP, Gravity)	No ship data	n/a	n/a	n/a	n/a