

*NOAA SHIP OKEANOS EXPLORER R-337*  
*“America’s Ship for Ocean Exploration”*

**EX0905 Mapping Field Trials II**

**Mendocino Volcano Field I and II**

**June 17, 2009 to June 27, 2009**

**Newport, OR to Astoria, OR**

**CRUISE REPORT**

By

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## 1. Purpose

The purpose of this report is to document various mapping data sets collected during this cruise. This report is only a descriptive report for the data collection methodology considered sufficient to process and further analyze these data sets. For details about the mapping sensor setup onboard, please refer to “NOAA Okeanos Explorer mapping readiness report, 2009”, available from ship upon request.

## 2. Participating personnel

<b>Name</b>	<b>Position</b>	<b>Affiliation</b>
CDR Joe Pica	Ship’s Master	EX
Mashkoor Malik	Cruise coordinator	OER
LT Nicola Verplanck	Field Operations Officer	EX
Elaine Stuart	Senior Survey Technician	EX
Colleen Peters	Senior Survey Technician	EX
Michelle Heller	Mapping watch stander	UNH Intern
Sylvia Rodriguez-Abudo	Mapping watch stander	UNH Intern
David Armstrong	Mapping watch stander	UNH Intern
Joel DeMello	Mapping watch stander	UNH Intern

## 3. Mapping sonar setup

NOAA Okeanos Explorer (EX) is equipped with a 30 kHz Kongsberg EM 302 multibeam sonar and a 3.5 kHz Knudsen sub-bottom profiler (SBP 3260). Due to ongoing interference problems only the EM 302 was used to collect data during this cruise.

EM 302 is also capable of recording bottom and water column backscatter. The water column backscatter data were only recorded during the times when an interesting feature was observed in the water column. For most of the cruise the EM 302 only recorded bottom bathymetric and backscatter. The ship used a POS/MV ver 4 to record and correct the multibeam data for any motion. C-NAV GPS system provided DGPS correctors with position accuracy expected to be better than 2.0m.

All the corrections (motion, sound speed profile, sound speed at sonar head, draft, sensor offsets) are applied during real time data acquisition in SIS ver. 1.04. XBT casts (Deep blue Max depth 760 m) were taken every 8 hours (0000, 0800 and 1600 local time). XBT cast data were converted to SIS complaint format using NOAA Velociwin ver. 8.92 Plus.

Onboard processing of bathymetric data was done in CARIS HIPS ver. 6.1 during which the data were cleaned in ‘Swath Editor’ and ‘Subset Editor’.

The latest patch test for the EM 302 was performed in May 2009 which showed only a pitch bias of 0.7 degrees. These patch test values were used during data acquisition throughout this cruise.

## 4. Cruise Calendar

June 2009						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
15	16 Mission party boarded	17 Departure Newport, OR	18 Mapping Gorda Ridge	19 Mapping Gorda Ridge	20 Mapping volcanic Field II	21 Small boat operations Mapping volcanic Field II
22 Small boat operations Transit to volcanic field I	23 DP Training Transit to volcanic field I	24 Mapping volcanic Field I	25 Mapping volcanic Field I Transit to Astoria, OR	26 Transit to Astoria, OR	27 Arrival Astoria, OR	28

## 5. Daily cruise log

(ALL TIMES LOCAL PDT)

### 17 June 2009

Set sail at 1400 PDT from Newport, OR to northern edge of Gorda Ridge earlier mapping with ETA 18 June 0800 PDT. Mapping ops will commence tomorrow morning to supplement the data collected during EX0904.

Mission party boarded the ship on 16 June 0330 PDT. June 16 and 17 was spent to orient the visiting student interns with ship operations. Also SST Stuart and SST Peters ran training sessions on using mission control room and operating Multibeam acquisition system. PS Malik did a training session on general mapping principles and mapping objectives of this cruise.

Over night transit to the Gorda Ridge.

**18 June 2009** – Continued mapping filling in data holidays left during the EX0904 cruise. Observed some interesting features in the EM 302. Not having sufficient scientific information available onboard, the images were sent to Dr. Jim Gardner (UNH) for further scientific investigation.

Email Replies from Dr. Gardner:

*“The main structure you transited over is called Heceta Bank. It is indeed a big fold caused by the Juan de Fuca plate under thrusting the North American plate. MBARI*

*mapped it with an EM300, but their resolution only allows gridding at 30 m/pixel; consequently, their data don't show all that beautiful fold structure. MBARI and Chris Goldfinger at Oregon State Univ. have both published on Heceta Bank and a USGS guy named Park Snavely published on seismic data from the bank. As for the strange pattern on the SW part of your line; their data do show a lot of surface texture in that area. I'm guessing the texture is reflecting outcrops, again caused by compression between the two plates. So, that transit line is beautiful, but I don't think it qualifies as a "discovery". I put an sd file I made from the MBARI EM300 data on the ccom anonymous server in a folder called "For\_Mashkoor". Perhaps you can download it. It's 51.6 mb."*

Due to slow speed internet connection the ship was not able to download the file.

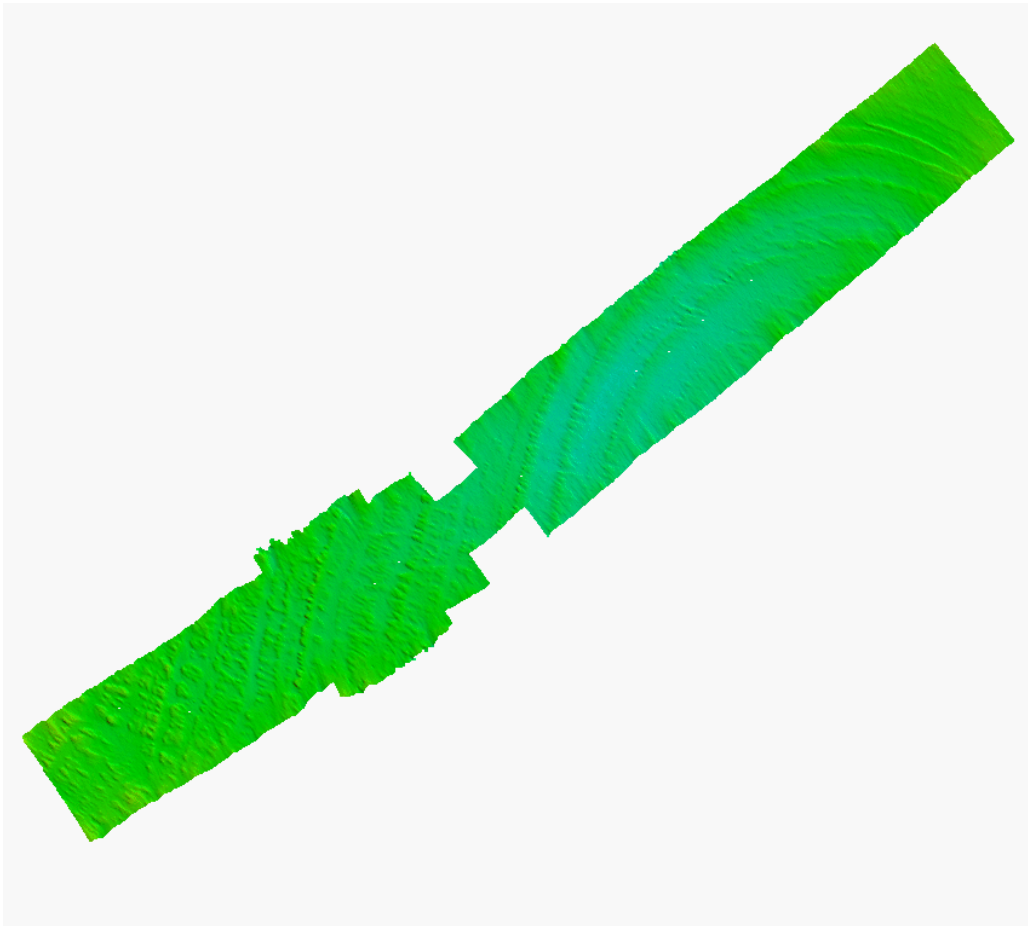


Figure1: Interesting circular features observed during transit from Newport, OR to Gorda Ridge.

**19 June 2009** – Completed the mapping in the Gorda Ridge and now transiting to Volcanic field # 2. During transit to the Volcanic field, an attempt will be made to overlap the existing data.

XBT cast #5 at 1600. At 1950 changed Along direction from 3 to 0 to help sonar keep bottom track. Had to force depth routinely before the shift change. XBT cast #6 conducted at 2345.

**20 June 2009** - mapping in transit to Mendocino ridge volcano site #1. Had to force depth few times to help sonar find ocean floor. UPS malfunctioned during night and now operating in by-pass mode. Over night mapping in the southern section of volcanic field to find the extent of volcanism.

XBT cast #7 at 0800. XBT cast #8 at 1600. At 1855, all lights in POS turned red but bounced back after a few seconds. First bulb in SIS also went red. Corrected itself.

**21 June 2009** - 1400 stopped mapping to start small boat operations drill. The small rescue boat is a new addition to EX inventory and its engine needs to be broken in to make it fully operational.

2100 XBT cast #11 (XBT\_062109\_11\_thinned.asvp). Small boat ops until 5pm. At 1850 Pos/MV dropout ~ around similar time as yesterday. All lights turned red but went back to normal after a few minutes.

**22 June 2009** – Overnight transited to the northern side of volcanic field II and now heading towards east. Small boat ops started 0900 PDT and will continue till afternoon. Once finished with boat operations started transit to volcanic field I.

1743 XBT cast #14 (XBT\_062209\_14\_thinned.asvp). XBT cast #15 conducted at 2100 (XBT\_062209\_15\_thinned.asvp) because of the large difference (~4 deg.) between the last probe and the temperature probe.

**23 June 2009** - 0000 XBT cast #16 (XBT\_062309\_16\_thinned.asvp). It was repeated because of a jump in temperature around 200m. The file was overwritten. At 0620 the ballast tanks were emptied, changes in depth may have impact on data. 0800 XBT cast #17 (XBT\_062309\_17\_thinned.asvp).

1100 – 1600 Bridge DP training was carried out for bridge watch keepers. Collected ~ 1 hours of data at a single location (Line#0035\_20090623\_204327\_EX) which can be useful for calculating standard deviations on the data.

1856 XBT cast #18 (XBT\_062309\_18\_thinned.asvp). At 2006, experienced “red triangle of death” which corrected itself within a few seconds.

**24 June 2009** – 0000 XBT cast #19 (XBT\_062409\_19\_thinned.asvp). Everything normal.

0900 – 1115 CTD cast over new volcano/ seamount.

1600 XBT #20 (XBT\_062409\_20\_thinned.asvp). Rough seas causing system to regularly lose the bottom (seas 6-10ft). PV-POS dropouts during turn at 2050. UPS alarm went off at 2145.

**25 June 2009** – Due to very rough sea conditions the ship was unable to maintain speeds higher than 7 kts.

0200 – Ship decided to break off the survey to start heading for Astoria, OR. Did not finish the extent of volcanic field I fully.

## 6. Table of XBT/ CTD casts

Date	Time (Local Time)	XBT/CTD Filename	Lat	Long	Remarks
061809	0800	TD_0001	43.0 N	126.67 W	
061809	1600	TD_0002	42.0 N	127.17 W	
061909	0000	TD_0003	40.9 N	127.8 W	
061909	0800	TD_0004	40.39 N	128.75 W	
061909	1600	TD_0005	40.2 N	130.35 W	
062009	0000	TD_0006	40.1 N	131.804 W	
062009	0800	TD_0007	39.993 N	133.46 W	
062009	1600	TD_0008	39.89 N	134.28 W	
062109	0000	TD_0009	39.92 N	132.77 W	
062109	0800	TD_0010	39.81 N	134.38 W	
062109	2100	TD_0011	40.1 N	134.64 W	
062209	0000	TD_0012	40.14 N	133.98 W	
062209	0800	TD_0013	40.25 N	133.68 W	
062209	1743	TD_0014	40.33 N	132.46 W	
062209	2100	TD_0015	40.38 N	131.56 W	
062309	0000	TD_0016	40.42 N	130.94 W	
062309	0800	TD_0017	40.45N	129.66W	
062309	1856	TD_0018	40.98 N	129.69 W	
062409	0000	TD_0019	41.43 N	129.63W	
062409	0900	EX0905_NewSeamount_01.hex	40.62 N	129.649 W	
062409	1600	TD_0020	41.1 N	129.55 W	
062509	0000	TD_0021	41.1 N	129.48 W	

## 7. Table of data files collected during the cruise

S.No.	Date	File Name	Location	Remarks
1	061809	0001_20090618_012534_ShipName	Transit	
2		0004_20090618_020102_ShipName	Transit	Interesting features < 100 m depth
3		0003_20090618_015219_ShipName	Transit	

4		0005_20090618_080102_ShipName	Transit	
5		0006_20090618_140111_ShipName	Transit	
6		0000_20090618_151922_EX	Gorda Ridge	
7		0001_20090618_211919_EX	Gorda Ridge	
8	061909	0002_20090619_031924_EX	Gorda Ridge	
9		0003_20090619_091922_EX	Gorda Ridge	
10		0000_20090619_104840_EX	Mendocino	
11		0001_20090619_140050_EX	Mendocino	
12		0002_20090619_200044_EX	Mendocino	
13	062009	0003_20090620_020047_EX	Mendocino	
14		0004_20090620_080049_EX	Mendocino	
15		0005_20090620_140049_EX	Mendocino	
16		0006_20090620_200052_EX	Mendocino	
17		0007_20090620_205132_EX	Mendocino	Turn
18		0008_20090620_205506_EX	Mendocino	
19		0009_20090620_212151_EX	Mendocino	Turn
20		0010_0090620_212308_EX	Mendocino	
21	062109	0011_20090621_030329.EX	Mendocino	
22		0012_20090621_062817.EX	Mendocino	
23		0013_20090621_065416_EX	Mendocino	
24		0014_20090621_125423_EX	Mendocino	
25		0015_20090621_162918_EX	Mendocino	Turn
26		0016_20090621_162918_EX	Mendocino	
27		0017_20090621_200225_EX	Mendocino	
28		0018_20090621_214334_EX	Mendocino	
29	062209	0019_20090622_002107_EX	Mendocino	
30		0020_20090622_040501_EX	Mendocino	Turn
31		0021_20090622_071550_EX	Mendocino	
32		0022_20090622_103748_EX	Mendocino	
33		0023_20090622_155838_EX	Mendocino	Small Boat, Wide turns
34		0024_20090622_170741_EX	Mendocino	
35		0025_20090622_180126_EX	Mendocino	Small Boat, Wide turns
36		0026_20090622_185229_EX	Mendocino	
37		0027_20090622_191737_EX	Mendocino	Small Boat, Wide turns
38	062309	0028_20090622_194139_EX	Mendocino	
39		0029_20090623_014145_EX	Mendocino	Transit to volcano field 1
40		0030_20090623_074142_EX	Mendocino	
41		0031_20090623_091112_EX	Mendocino	
42		0032_30090623_135501_EX	Mendocino	Multiple turns
43		0033_20090623_145744_EX		Detected a seamount
44		0034_20090623_170715_EX		DP Training
45		0035_20090623_204327_EX	Mendocino	
46		0036_20090623_232407_EX	Mendocino	
47		0037_20090623_235519_EX	Mendocino	
48		0038_20090624_031053_EX	Mendocino	Turn
49		0039_20090624_052316_EX	Mendocino	Turn
50		0040_20090624_055139_EX	Mendocino	
51		0041_20090624_115139_EX	Mendocino	
52		0042_20090624_125159_EX	Mendocino	Turn
53		0043_20090624_132859_EX	Mendocino v1	

54		0044_20090624_150011_EX	Mendocino v1	Turning back to go to do a CTD cast at the seamount
55		0045_20090624_183456_EX	Mendocino	CTD cast + turns
56		0046_20090624_190302_EX	Mendocino	W-E Cross of seamount
57		0047_20090624_195623_EX	Mendocino	Transit to original survey line of the day
58	062409	0048_20090624_204540_EX	Mendocino	
59		0049_20090625_024539_EX	Mendocino	
60		0050_20090625_032609_EX	Mendocino	Turn
61	062509	0051_20090625_034923_EX	Mendocino	
62		0052_20090625_090147_EX	Mendocino	
63		0007_20090625_091127_EX	Transit	Transit to Astoria, OR
64		0008_20090625_151121	Transit	Transit to Astoria, OR
65		0009_20090625_211121_EX	Transit	Transit to Astoria, OR
66	062609	0010_20090626_031123_EX	Transit	Water column data collected as well
67		0011_20090626_091124_EX	Transit	Water column data collected as well
68		0012_20090626_151121_EX	Transit	Water column data collected as well

## 8. Table of Cruise Statistics

Dates	JD169 to JD176
Weather delays	0 days
Total non-mapping days	0 days
Total mapping days	10 days
Line kilometers of survey	2817 km
Beginning draft	4.62 m (bow) 4.43 m (stern)
Average ship speed for survey	9.3 kts
Total Volcanic Field 1 & 2 area mapped	943 & 2, 912 nm <sup>2</sup>

## 9. Data results: Please see attached map sheets

8.1. Over view of exploration area

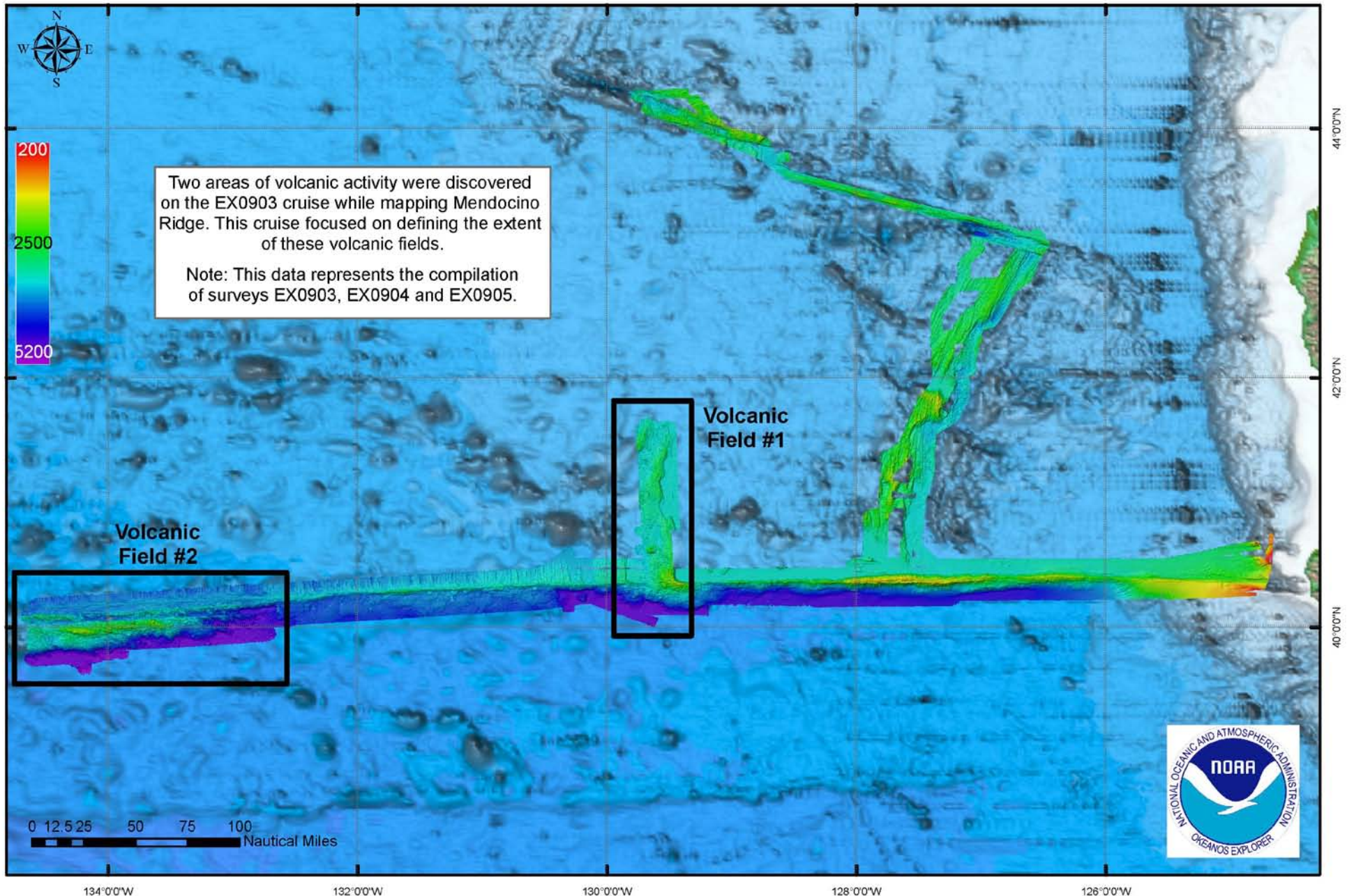
8.2 Detailed views of interesting features observed

8.3 Location of XBTs overlaid with the bathymetric data collected during this cruise



# EX0905 Mapping Field Trials II: Exploring Extent of Volcanic Fields Mendocino Ridge June 17-27, 2009

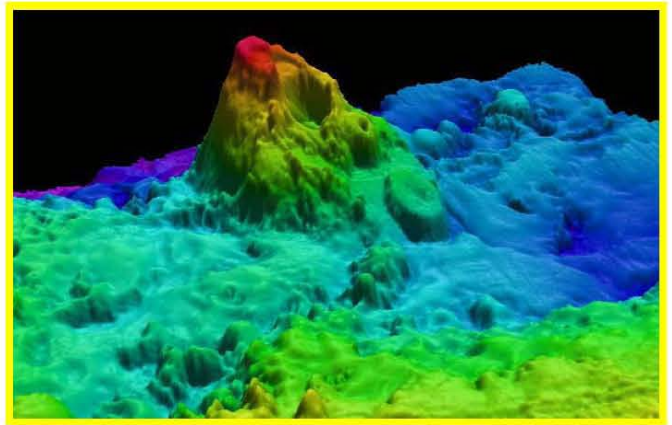
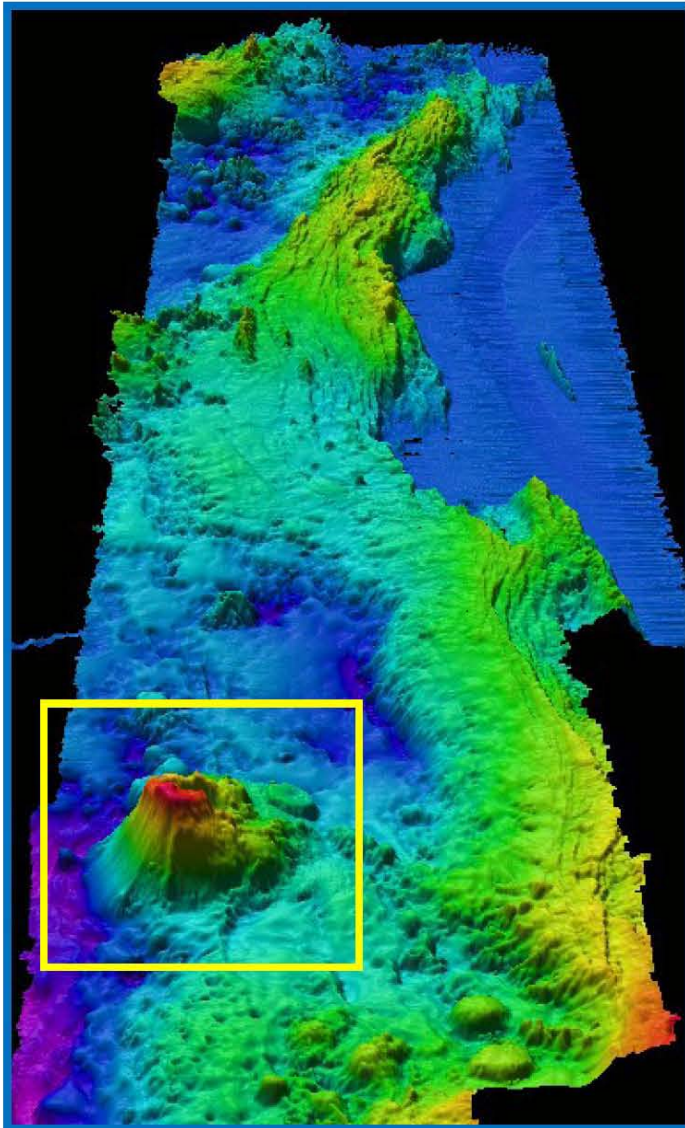
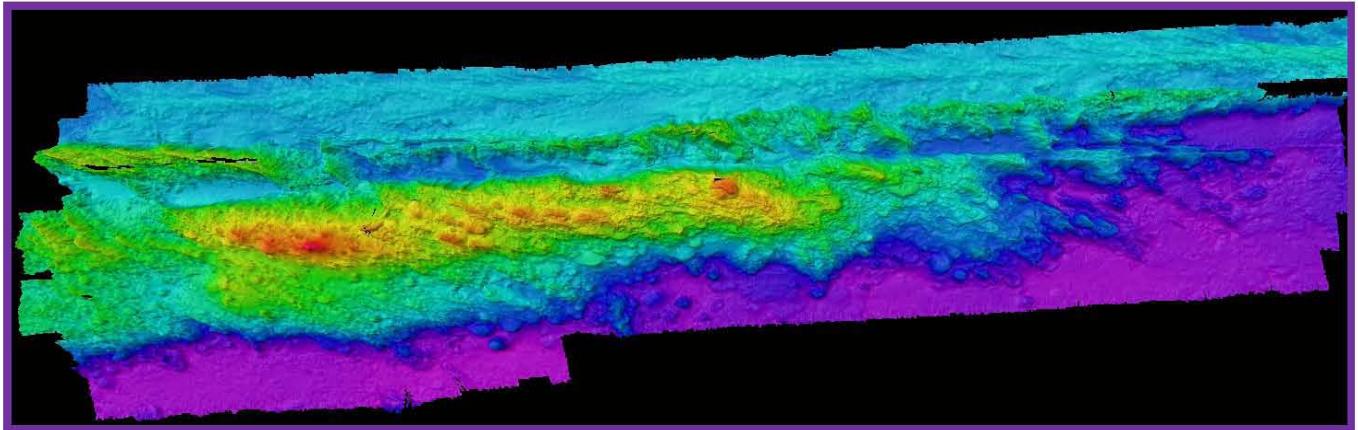
Total miles mapped: 1,470.75 nm





# EX0905 Mapping Field Trials II: Exploring Extent of Volcanic Fields

Mendocino Ridge June 17-27, 2009

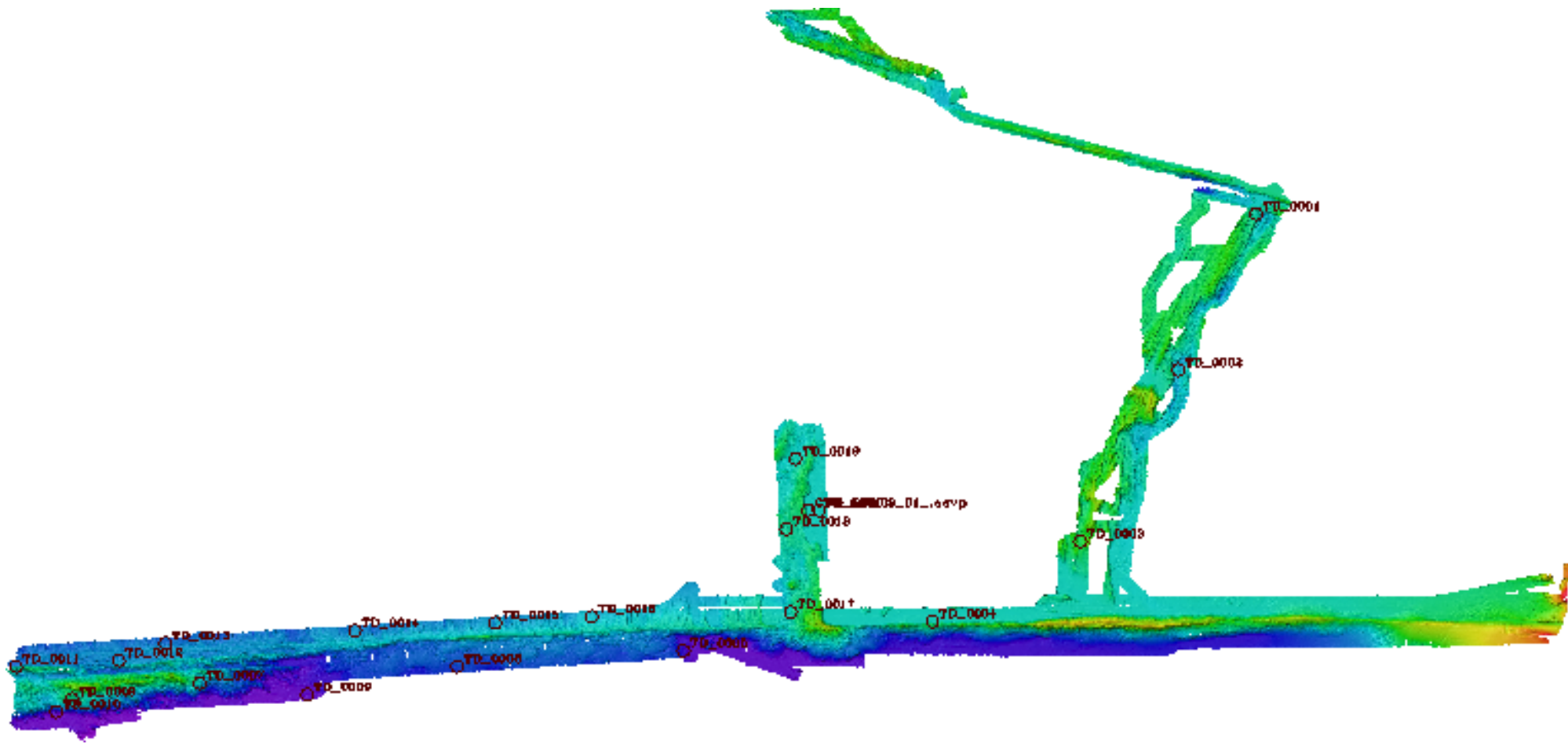


**Upper left:** Plan view of Volcanic Field #2. This region includes data from cruises EX0903 and EX0905. The northern and southern lines were completed on EX0905 to determine the extent of the volcanic field.

**Left:** A perspective view looking north at Volcanic Field #1. Note the seamont on the southwest corner and the channel in the northeast.

**Above:** A perspective view looking southeast at a newly discovered seamont with a distinct caldera.





8.3 Bathymetric map overlaid with XBT casts