

NOAA *Okeanos Explorer* Program

MAPPING DATA ACQUISITION AND PROCESSING REPORT

CRUISE EX-14-02 Leg 3

Exploration, Gulf of Mexico
ROV & Mapping

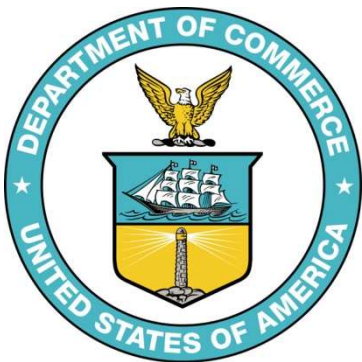
April 10, - May 1, 2014
Galveston, Texas - Tampa, Florida

Report Contributors:

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December 1, 2017

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1. Introduction



The NOAA Office of Ocean Exploration and Research and the NOAA Ship *Okeanos Explorer*

Commissioned in August 2008, the NOAA Ship *Okeanos Explorer* is the nation's only federal vessel dedicated to ocean exploration. With 95% of the world's oceans left unexplored, the ship's combination of scientific and technological tools uniquely positions it to systematically explore new areas of our largely unknown ocean. These exploration cruises are explicitly designed in collaboration with the broad science community to provide a foundation of publicly accessible baseline data and information to support science and management needs. This baseline information often leads to further more detailed investigations by other parties.

The unique combination of mission capabilities including a high-resolution multibeam sonar deep water remotely operated vehicles, telepresence technology, and integrated data management system quicken the scientific discovery and dissemination process. These systems enable us to identify new targets in real time, dive on those targets shortly after initial detection, and then send this information back to shore for immediate near-real-time collaboration with scientists and experts at Exploration Command Centers around the world. The integrated data management system provides for the quick dissemination of information-rich products to the scientific community. This ensures that discoveries are immediately available to experts in relevant disciplines for research and analysis.

Through the operation and maintenance of the mission capabilities, NOAA's Office of Ocean Exploration and Research (OER) provides the nation with unparalleled capacity to discover and investigate new oceanic regions and phenomena, conduct the basic research required to document discoveries, and seamlessly disseminate data and information-rich products to a multitude of users. OER strives to develop technological solutions and innovative applications to critical problems in undersea exploration and to provide resources for developing, testing, and transitioning solutions to meet these needs.

***Okeanos Explorer* Management – a unique partnership within NOAA**

The *Okeanos Explorer* mode of systematic telepresence-enabled exploration requires a robust shore-based high speed network and infrastructure. The ship is operated, managed and maintained by NOAA's Office of Marine and Aviation Operations, which includes commissioned officers of the NOAA Corps and civilian wage mariners. OER owns and is responsible for operating and managing the cutting-edge ocean exploration systems on the vessel (ROV, mapping and telepresence) and ashore including Exploration Command Centers and terrestrial high speed networks. The ship and shore-based infrastructure combine to be the only federal program dedicated to systematic telepresence-enabled exploration of the planet's largely unknown ocean.

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2. Report Purpose

The purpose of this report is to briefly describe the mapping data collection and processing methods, and to report the results of the cruise. For a detailed description of *Okeanos Explorer* mapping capabilities, see the appendices section 'Kongsberg EM 302 Multibeam Sonar Description and Operational Specifications' and the ship's readiness report, which can be obtained by contacting the ships operations officer (ops.explorer@noaa.gov).

This report focuses on mapping exploration activities which occurred during expedition EX-14-02 Leg 3. This expedition was comprised of overnight mapping operations and daytime ROV dives. The working grounds were in the northern Gulf of Mexico, with operations occurring between Keathley Canyon and the Florida Escarpment. A separate cruise report will describe the ROV operations.

Mapping objectives for the cruise included site characterization at ROV dive locations, and extending existing mapping data coverage in the region. The full set of cruise objectives for EX-14-02 Leg 3 were defined in EX-14-02 Leg 3 Project Instructions. The following subset of objectives describes mapping objectives for the cruise. All were achieved unless otherwise noted.

- Identify and explore the diversity and distribution of benthic habitats and features in the region (e.g., seeps, deep corals and related benthic ecosystems, canyons).
- Locate and characterize underwater cultural heritage e.g., shipwrecks (data will be used to assess their eligibility for the National Register of Historic Places).
- Ground-truth acoustic seep data and characterize associated habitat.

- Conduct night time mapping operations and holiday filling, including continuous acquisition of EM 302 multibeam, EK 60 singlebeam, and Knudsen subbottom profiler data.
- Support ROV dive planning by producing mapping products.
- Conduct mapping operations during transit, with possible further development of exploration targets.
- Conduct training of new mapping watchstanders.
- Conduct CTD/rosette casts as needed.
- Provide a foundation of publicly accessible data and information products to spur further exploration, research, and management activities.
- Provide daily cumulative multibeam products to shore for operational decision making purposes.

3. Participating Mapping Personnel

NAME	ROLE	AFFILIATION
CDR Ricardo Ramos	Commanding Officer	NOAA Corps
LT Emily Rose	Field Operations Officer	NOAA Corps
Elizabeth “Meme” Lobecker	Expedition Coordinator / Mapping Team Lead	NOAA OER (ERT Inc.)
Kelley Elliott	Expedition Manager	NOAA OER (20/20 Inc.)
Jacklyn James	Survey Technician	NOAA OMAO
Jeffrey Marshall	Physical Scientist, Mapping Watch	NOAA AHB

4. Summary of Major Findings

Cruise Map

Figure 1. Cruise map made in ArcMap 10 showing overall cruise track and key operational areas.



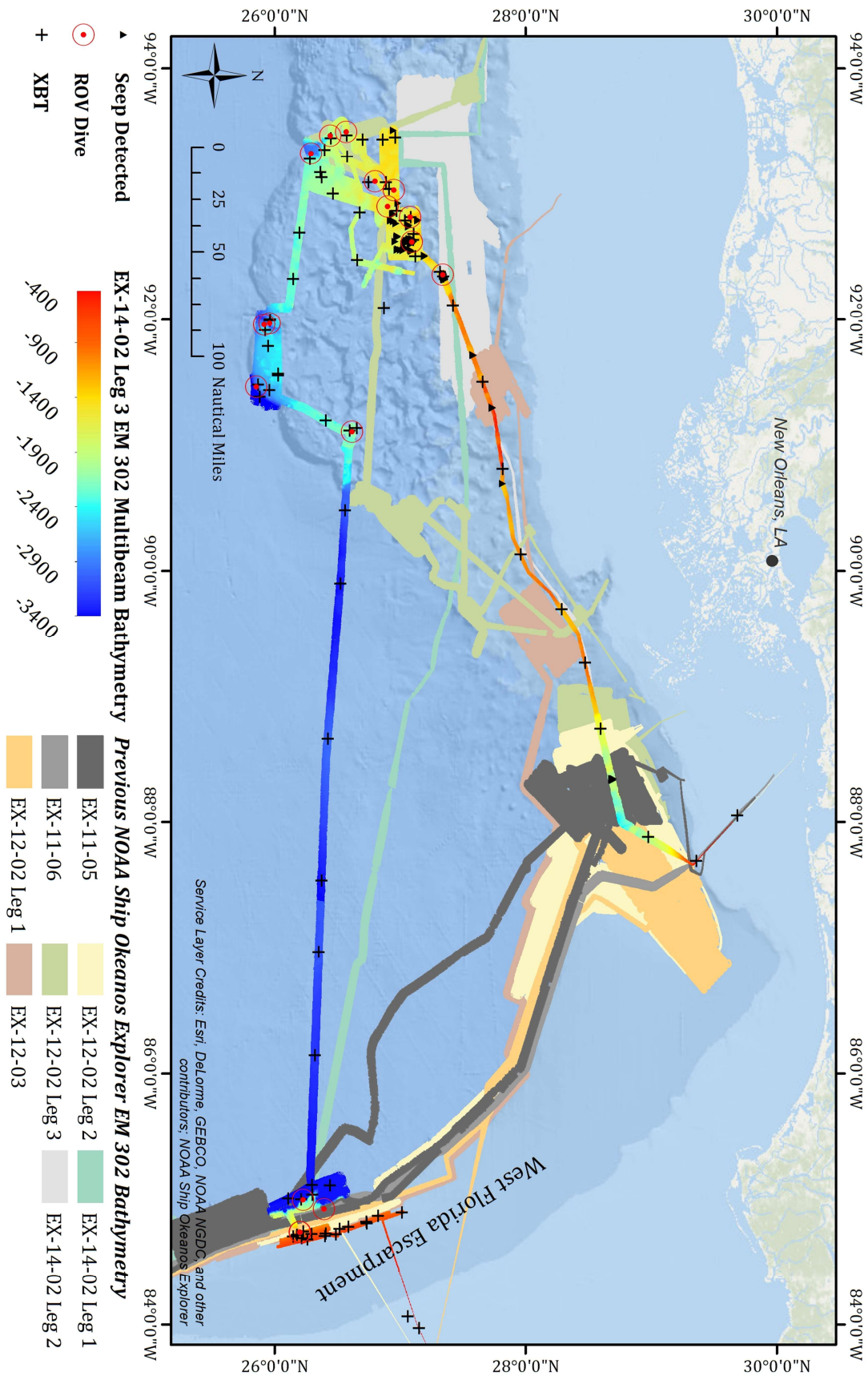
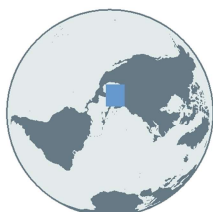
Ocean Exploration and Research

EX-14-02 Leg 3

Gulf of Mexico Exploration

ROV & Mapping

April 10 - May 1, 2014



5. Mapping Statistics

Dates	April 10 – May 1, 2014
Days lost to weather	0 days
Total mapping days	days
Total non-mapping days	22 days
Line kilometers of survey	4443
Square kilometers mapped	17,600
Number / Data Volume of EM 302 raw bathymetric / bottom backscatter multibeam files	320 / 28 gb
Number / Data Volume of EM 302 water column multibeam files	320 / 89 gb
Number / Data Volume of EK 60 water column singlebeam files	384 / 4.96 gb
Number / Data Volume of subbottom sonar files	194 / 2.19 gb
Number of XBT casts	77
Number of CTD casts (including test casts)	0
Beginning draft	FWD - 15' 05", AFT - 14' 02"
Ending draft	FWD- 14'6", AFT -13'11"

6. Mapping Sonar Setup

The NOAA Ship *Okeanos Explorer* is equipped with a 30 kHz Kongsberg EM 302 multibeam sonar capable of mapping the seafloor in 0 to 8000 meters of water. The system generates a 150° beam fan containing up to 432 soundings per ping in waters deeper than 3000 meters. In waters less than 3000 meters, the system is operated in multiping, or dual swath mode, and obtains up to 864 soundings per ping, by generating two swaths per ping cycle. The ship is also equipped with a Kongsberg EK 60 singlebeam fisheries sonar. The transducer operates at 18 kHz and transmits a 4° beam fan. Additionally the ship is equipped with a Knudsen 3260 subbottom profiler. The transducers produce a 3.5 kHz chirp signal.

7. Data Acquisition Summary

EX-14-02 Leg 3 operations included EM 302 multibeam, EK 60 singlebeam, and Knudsen subbottom profile data collection. Mapping data collection generally commenced in the evening after the ROV was recovered and safely secured on deck, and continued through the night into the morning until arrival at the day's ROV dive site.

Expendable bathythermographs were collected every two to four hours to correct multibeam data for changes in sound speed in the water column, and were applied in real time using Seafloor Information Software (SIS). Sound speed at the sonar head was determined using a Reson SVP-70 probe and the thermosalinograph. Data from these two systems was monitored for consistency throughout the cruise, and whichever was performing better was applied in real-time using SIS.

Background data used for exploration mapping included multibeam data collected by the Extended Continental Shelf project, R/V Atlantis cruise 18-02, existing data in the National Geophysical Data Center archives, and Sandwell and Smith satellite altimetry bathymetric data.

EX-14-02 Leg 3 Mapping Data Report

Tables listing all sonar files collected and products created during the cruise are provided in the appendices of this report. Tables listing all sound velocity files collected during the cruise are also provided.

8. Sonar Data Quality Assessment and Data Processing

EM 302 Multibeam Bathymetry Data

A patch test was run on February 6, 2014. The offsets were determined to have not changed from previous years.

Offset Test	Offset
Timing	0 seconds
Pitch	-0.725°
Heading	0°
Roll	0°

Table 1. EM 302 transducer offset values determined during EX-14-01 and applied during EX-14-02 Leg 3.

Throughout the cruise, multibeam data quality was monitored in realtime by acquisition watchstanders. XBTs were conducted every two to four hours as necessary to maintain data quality. Ship speed was adjusted to maintain data quality as necessary. Line spacing during focused mapping surveys was planned to ensure ¼ to 1/3 overlap between lines at all times. Cutoff angles in SIS were generally set to 75° on both the port and starboard sides. In heavy seas, cutoff angles were limited to improve data quality.

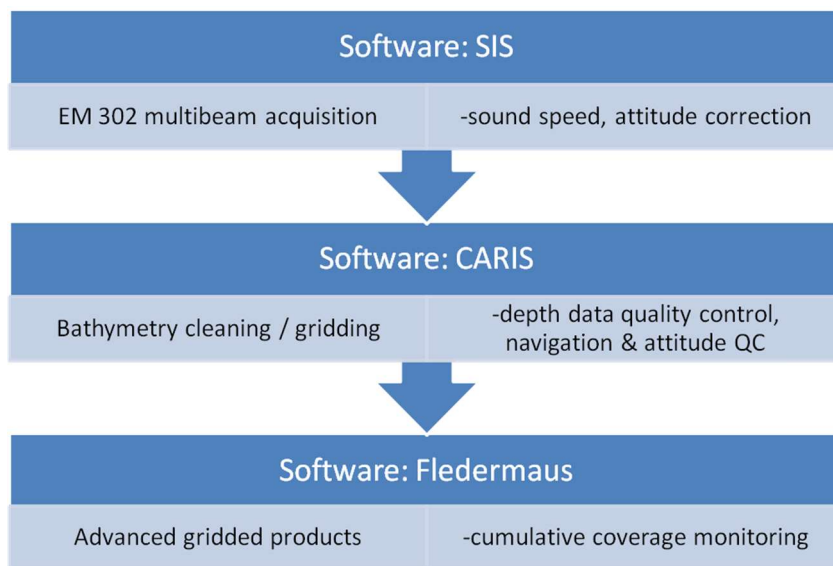


Figure 2. Shipboard multibeam data flow.

Raw multibeam bathymetry data files were acquired by SIS, and were imported into CARIS. In CARIS, attitude and navigation data stored in each file were checked for quality, and erroneous soundings were removed using CARIS Swath Editor and Subset Editor. Once per day, cleaned, gridded bathymetric data were exported to ASCII text files (y,x,z) at 50 meter cell size in WGS84 datum. The ASCII files were then

used to create Fledermaus SD objects. These SD objects were then exported to geotiff and Google Earth KMZ, which were copied to the shoreside FTP on a daily basis for shoreside scientist participation.

EM 302 Multibeam Water Column Backscatter Data Processing

Water column data was processed using Fledermaus Midwater to inspect for the presence of seeps and other water column anomalies. Seep locations were picked from fan view using the geopick tool, exported to xyz, and provided to ROV navigator to aid in seep discovery. In some cases, seeps that appeared as single streams in multibeam data were observed as several distinct streams emanating from the seafloor.

EM 302 Multibeam Bottom Backscatter Data Processing

Bottom backscatter data was processed using Fledermaus Geocoder Tool (FMGT) at ROV dive locations to determine information about relative acoustic reflectivity of local seafloor. It was very useful in locating potential hard substrate for coral colonization and discovery. At times the substrate seemed harder and at times it appeared that the irregularity of the seafloor was the cause for higher backscatter returns.

EM 302 Built In System Tests (BISTs)

BISTs were run throughout the cruise to monitor multibeam sonar system status. These are archived as ancillary files with the EM 302 bathymetry dataset.

EM 302 Multibeam Crossline Analysis

Gridded mainscheme lines were imported into Qimera Crosscheck and gridded at 50 meters. The Crosscheck analysis routine was utilized to compare gridded mainscheme data to the raw crossline file, and the results for each comparison are shown below, indicating the data meets International Hydrographic Organization Order 1 survey requirements.

The crossline was:

0190_20140423_221909_EX1402L3_MB.all

The mainscheme lines were:

0163_20140422_040855_EX1402L3_MB.all

0173_20140423_030301_EX1402L3_MB.all

0178_20140423_052500_EX1402L3_MB.all

0185_20140423_084337_EX1402L3_MB.all

000000400131	# Number of Points of Comparison
-2585.712910	# Data Mean
-2585.866480	# Reference Mean
0.153570	# Mean
-96.069270	# Median
6.613741	# Std. Deviation
-3163.34 -2196.55	# Data Z - Range
-3016.59 -2323.04	# Ref. Z - Range
-601.26 393.58	# Diff Z - Range
13.381052	# Mean + 2*stddev
109.296752	# Median + 2*stddev
30.203640	# Ord 1 Error Limit
0.000447	# Ord 1 P-Statistic

179 # Ord 1 - # Rejected
 1 # Order 1 Survey ACCEPTED

EK 60 Splitbeam Sonar Data

EK 60 data was collected continuously during mapping operations throughout the cruise. Data collection tracklines are shown in the cruise map in Fig. 1. Attitude data from the POS/MV is being written to files.

An EK 60 calibration was conducted on March 2nd and 3rd 2014 offshore of Key West. The files are included in the EX-14-02 Leg 1 EK 60 dataset.

Knudsen 3260 Subbottom Profiler Data

Subbottom data was collected continuously during mapping operations throughout the cruise. Minor data collection holidays occurred in due to inclement weather and while personnel were attempting to input attitude data from the POS/MV into the acquisition software.

9. Telepresence

A 20 megabit / second ship-to-shore connection was available throughout the cruise.

10. Data Archival Procedures

All mapping data collected by *Okeanos Explorer* are archived and publically available within 90 days of the end of each cruise via the National Geophysical Data Center’s (NGDC) online archives. The complete EX-14-02 Leg 3 *Okeanos Explorer* data management plan is available in the EX-14-02 Leg 3 project instructions doi:10.7289/V5JW8BWV.

The EK 60 water column sonar dataset is accessible at <http://doi.org/10.7289/V5GQ6VP8>.
 The EM 302 water column backscatter dataset is accessible at <http://doi.org/10.7289/V5BZ63ZX>.
 EM 302 bathymetry and bottom backscatter
https://www.ngdc.noaa.gov/ships/okeanos_explorer/EX1402L3_mb.html
 Knudsen 3260 subbottom. www.ncei.noaa.gov

11. Cruise Calendar

All times listed are in UTC. Local ship time was -4 hours from UTC.

April / May 2014						
Sun	Mon	Tues	Wed	Thur	Fri	Sat
				10 Depart dock, Pascagoula MS	11 Exploration mapping during transit to ROV Dive 01	12 Focus oil seep mapping, transit mapping between ROV dives
13 Monterey Wreck mapping, Keathley Canyon mapping	14 Normal mapping/ROV dive operations	15 Heavy weather, medical helicopter evacuation, opportunistic mapping	16 Normal mapping/ROV dive operations	17 Normal mapping/ROV dive operations	18 Normal mapping/ROV dive operations	19 Morning mapping. ROV Dive 07. Evening mapping.
20	21	22	23	24	25	26

Morning mapping. ROV Dive 08. Evening mapping.	Morning mapping. ROV Dive 08. Evening mapping.	Morning mapping. ROV Dive 11. ARGOS deployment. Evening mapping.	Normal mapping/ROV dive operations	Normal mapping/ROV dive operations	24 hour mapping, no ROV dive	Normal mapping/ROV dive operations
27 Normal mapping/ROV dive operations	28 Normal mapping/ROV dive operations	29 Normal mapping/ROV dive operations	30 Transit mapping, sonars secured at 60 meter water depth	1 In port, Tampa FL		

12. Daily Cruise Log

All times listed are local ship time, which was -5 hours from UTC.

April 8, 2014

Mapping team lead arrived to the ship, began preparing data for exploration and waking up mapping systems.

April 9, 2014

Mapping personnel arrived to the ship, including Jeffrey Marshall, a Physical Scientist from the NOAA Atlantic Hydrographic Branch.

April 10, 2014

A BIST was run at the dock and all tests passed. Subbottom data is no longer receiving heave; subsequently the comport inputs are being troubleshoot. Mapping department members transitioned to night watch schedules. Cumulative Gulf of Mexico mapping data, including data from Leg 2, was prepared for exploration decision making. Seep locations determined during water column data processing during Leg 2 were used to plan the April 11 ROV dive track. Multibeam, split beam, and subbottom sonar data collection commenced in 40 meters of water offshore from Pascagoula.

April 11, 2014

Multibeam, split beam, and subbottom sonar data collection continued throughout the day and night during transit to dive site. The transit line was planned to complement existing EX data. Weather was fair and data quality on all sonars was high. The first set of daily multibeam products were sent to shore. New watchstander training continued. Lower interior space needle gunning briefly caused reduction of data quality on all three sonars but was remedied quickly. Heave data input into Knudsen continues to be troubleshoot.

April 12, 2014

Seeps for today's ROV dive were remapped in the morning. Active seeps appeared to have shifted since initial detection during Leg 2, the previous cruise to this cruise. Three passes over the area seemed to indicate that seeps are intermittent, as even during this morning short survey of a few hours, different seeps were detected during each pass. Data quality on all sonars was high. Evening survey operations began with focused EK 60 data collection over an oil bubble seep location, and then retracing the ROV dive track for the day at speeds of 4 to 5 kts. Data will be used by acoustic scientists to compare video data of seeps with acoustic signal strength. Transit to ROV dive site 2 commenced for survey and dive target refinement in the early morning.

April 13, 2014

Morning mapping operations continued until arrival at ROV dive site 2. Dive 2 track was refined based on water column data collected evening of 4/12, including several newly identified seeps.

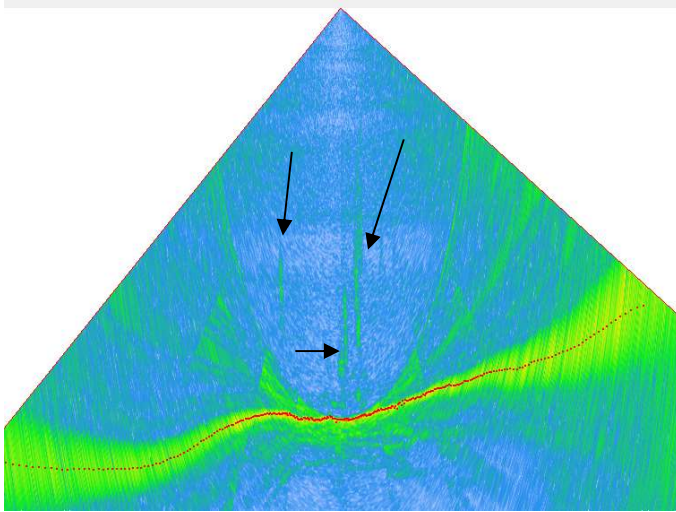


Figure 3. Multiple seeps (black arrows) detected with EM 302 multibeam sonar just prior to ROV dive 03. MB line 0024.

Evening mapping operations commenced in the late afternoon when the ROV was recovered early due to ship engines overheating from Sargassum in cooling intakes. Mapping lines focused on mapping Monterey wreck sites, and extending existing EX coverage in the area, including near Keathley Canyon. Wrecks were not detected in our multibeam data due to depth. Data quality was high on all sonars. All BISTs run during cruise so far have passed.

Highlights of the dive include a brine pool with a number of islands surrounded by carbonate outcrops; areas with bacterial staining and carbonate hardgrounds, including one with multiple streams of escaping oil and gas droplets from a living mussel bed, and others surrounded by chemosynthetic mussels and tube worms.

April 14, 2014

Morning mapping focused on filling areas complementing existing EX data in the region near ROV dives sites 2 and 3. Evening mapping commenced when the ROV dive ended early due to bow thruster overheating, and focused on areas near dive sites 3 and 4. Training of new mapping personnel continues to go well. Subbottom data continues to be collected overnight with no reported impact to habitability. All BISTs conducted thus far have passed.

The third ROV dive of the expedition was conducted today at Northwest Gulf Mid-Depth, a site put forward by Brian Kinlan of NOAA NCCOS to assess the sea floor along a variety of slopes for its suitability as deep sea coral habitat. Scattered carbonate hardground outcrops of varying size were encountered, with many larger outcrops encrusted with solitary corals and associates. An unexpected seep was discovered with an associated chemosynthetic community during the dive as well. The dive ended about a half hour to an hour early.

April 15, 2014

Multibeam, EK 60, and subbottom data quality degraded significantly in the early morning despite several survey headings, and logging was ceased at 5:45 AM local. Survey operations started again in the early afternoon after medical emergency evacuation of two personnel injured in the heavy overnight weather, and decision that transit to calmer waters was not efficient. Data quality with following seas 8-11 ft was decent and a single southerly running line was collected for several hours. After dinner, slow transit towards Keathley Canyon began for on time arrival to 4/16 dive site.

Today's ROV dive was cancelled due to the heavy sea state.

April 16, 2014

Survey operations continued in the morning en route to today's dive site at Keathly Canyon. Data quality was moderate and improved as seas laid down through the morning.

Evening survey operations commenced after the ROV was on deck at 1730. Mapping focused on a region between today and tomorrow's dives, extending existing EX coverage adjacent to Keathley Canyon. Data quality was high on all sonars.

It was noted during the ops briefing that the sonar closet was flooded with ~1 inch of water when the engineering department had to blow out the sargassum from the seawater intake screens. The water came in through the blue rock boxes that serve as transducer cable passthroughs at the base of the bulkhead. The water was quickly cleaned up and no impact was observed or expected. It was discussed that such events need to be conveyed to mapping team so that they can be added to long term documentation of the lifespan of the EM 302 sonar system.

April 17, 2014

Sonar data continued into the morning, and sonars were secured upon reaching 3 miles of the ROV wreck dive site. Sonar data quality varied depending on heading and the sea state.

Mapping data continued upon exiting the wreck site at the same point as entry, and lines focused on building coverage in the area between Keathley Canyon and the Monterey wrecks. Seismic survey ships working over Keathley Canyon impacted line planning. Sonar data quality varied depending on heading in the sea state.

Today's dive was conducted at Monterey Wreck sites C and A. 43 scientists and archaeologists (including 8 ECU maritime archaeology students) actively participated and help lead the dive, not including OER and shore-side operations personnel, making it the most highly-engaging telepresence dive in EX history.

April 18, 2014

Sonar data continued to be collected through the morning and ceased upon reaching the ROV dive site. Sonar data quality varied depending on heading in the sea state.

Evening mapping commenced in the late evening after the ETs completed installation of VSAT spares. Mapping lines focused on building coverage in the area between Keathley Canyon and Monterey Wreck B. Seismic survey ships working over Keathley Canyon impacted line planning. Sonar data quality was high in the evening. Sonar data quality varied depending on heading in the sea state.

During today's fire drill, simulated smoke was piped through the ship's ventilation system, and therefore also through the plastic tubing directly connecting a vent in the sonar closet to the EM 302 TRU. The tube was

removed after about 1 minute of simulated smoke exposure. The sonar appears to be functioning with no noted issues. The TRU was opened and no moisture was detected in first layer of interior equipment. Several BISTs were run and all passed. Kongsberg has been notified and is on standby if any problems are detected. If the mapping lead had not been aware of the plastic tubing and removed it, the TRU would have been exposed to simulated smoke for ~20 minutes. The plastic tubing will remain off until (if) it becomes necessary again. The sonar closet temperature is holding at 65 degrees F.

April 19, 2014

Morning mapping operations focused on building existing coverage in the area while avoiding seismic traffic. Mapping logging ceased 3 miles out from ROV dive site. Data quality was high on all sonars.

Evening mapping operations focused on building existing coverage during transit back to Keathley Canyon while again avoiding seismic traffic. Data quality was high on all sonars. Sonar data collection began once the ship exited the wreck restricted area by the same path whence we came.

April 20, 2014

Overnight mapping operations continued in the morning until arrival at dive site 08. Mapping data quality was high. Data for the day's dive was reviewed for presence of seeps and bottom backscatter targets, however none were detected.

Evening mapping operations commenced with the ROV secured on deck. Exploration mapping en route to tomorrow dive focused on overlapping with existing Law of the Sea data, and mapping the next two dive sites at Bryant Canyon.

April 21, 2014

Morning mapping focused on surveying both Bryant Canyon dive sites. New data was reviewed with shore in the morning and the dive track was refined according to bottom backscatter information. No seeps were detected in the area. Mapping data quality was high.

Evening mapping commenced with the ROV on deck and focused on surveying the dive 11 site and adding to *Okeanos* Bryant Canyon coverage. Mapping data quality was high.

Dive 09 of the Expedition was conducted today at Bryant Canyon “shallow”, climbing the eastern wall of the canyon to search for deep-sea corals. The dive traversed a heavily regimented seafloor with little biota.

April 22, 2014

Mapping continued in the morning until arrival at ROV dive site 11. Data collection focused on building on *Okeanos* dataset in vicinity of dives 9, 10, 11. Data quality on all sonars was high. A full BIST was run and all tests passed.

Evening mapping commenced after ARGOS float was deployed and again focused on building on *Okeanos* dataset in vicinity of dives 9, 10, 11. Data quality on all sonars was high.

Dive 10 of the Expedition was conducted today at Bryant Canyon “Deep”, climbing the western wall of the canyon to search for deep-sea corals and investigate benthic habitats. The dive was extended two hours and during ROV descent, transects were conducted in the water column from 800-1200m to document pelagic fauna, including potential prey for deep-diving whales.

April 23, 2014

Morning mapping continued building on EX Sigbee Escarpment data near ROV dives 4/21 and 4/22. Evening mapping focused on mapping potential shipwreck ('tar lilies') dive locations for 4/24. Potential shipwreck was not observed in any mapping data. Data quality on all sonars was high.

Dive 11 was conducted at NW Gulf Deep climbing the south facing slope of the Sigbee Escarpment to search for deep sea corals. Deep corals were imaged, including range extensions into deeper water for some species in the Gulf of Mexico.

April 24, 2014

Morning mapping continued in area just east of potential shipwreck ('tar lilies'). No data in the area will be held as sensitive, as anomalies were not shipwrecks, but were 'tar lilies'. Evening mapping focused on subbottom data collection over the anomalies, followed by commencement of transit to Florida Escarpment.

Dive 12 was conducted at WR0325, a suspected shipwreck. Upon arrival at the target identified as a side-scan sonar anomaly, the site was revealed not to be a shipwreck but instead a site with two asphalt volcanoes or tar extrusions on the seafloor, hosting both chemosynthetic and non-chemosynthetic life. Despite having planned for an archaeology dive, telepresence showed its merit as many other experts in the community joined the dive to provide input on what we were seeing. CBS news covered the discovery, and BOEM representatives were hosted at the Silver Spring ECC.

April 25, 2014

The ship spent the day transiting from the Northwestern operating area for the expedition to the Central-West Florida Escarpment (where we plan to conduct the remaining five dives of the expedition). 24 hour mapping occurred en route to Florida Escarpment. ROV team pitched in to fill a watchstander roll throughout the day, each standing watch for one hour. Data quality was good at transit speeds of 10 - 11 knots in very calm seas. Existing EX Florida Escarpment data was processed and provided to shore for dive planning.

No ROV dive occurred today.

April 26, 2014

Morning mapping included transit exploration mapping en route to the Florida Escarpment, and supplementing existing Okeanos data along the Escarpment. Dive 13 of the expedition was conducted today at "Large Mound Area Deep", conducting a transect up the west-facing escarpment wall to explore benthic habitats and search for deep-sea corals. During the dive, a live interaction was held with OER's Professional Development workshop at the Seattle Aquarium. Evening mapping focused on supplementing existing EX data along the Escarpment. Data quality on all sonars was high.

April 27, 2014

Morning mapping focused on adding to previous EX coverage of the break of the Florida Escarpment. Data quality was high. Evening mapping focused on adding to previous EX coverage of the Florida Escarpment in the shallow area near the next several dives, and remapping areas of poor backscatter data quality due to transits during heavy seas. Mapping areas were selected in collaboration with Peter Etnoyer and Brian Kinlan for coral habitat identification.

April 28, 2014

EX-14-02 Leg 3 Mapping Data Report

Morning and evening mapping continued building on inshore edge of existing data near ROV dives 15 and 16.

April 29, 2014

Morning mapping continued building on inshore edge of existing data near ROV dives 15, 16, and 17. A familiarization presentation describing key mapping equipment was given to ship's crew and ROV team in the morning and afternoon. The presentation was well received.

April 30, 2014

Mapping commenced in the morning when the ROV dive was cancelled. Mapping operations focused on expanding inshore edge of existing EX coverage in shallow water. Mapping continued throughout the day and ceased when 60 meters water depth was reached. Data quality was moderate in shallow water.

May 1, 2014

The ship pulled into port in Tampa, Florida. Cruise data packages were finalized. Mission personnel began to depart the ship.

13. References

The EK 60 water column sonar dataset is accessible at <http://doi.org/10.7289/V5GQ6VP8>.

The EM 302 water column backscatter dataset is accessible at <http://doi.org/10.7289/V5BZ63ZX>.

At the time of writing this report, DOIs for the following datasets were not yet available: EM 302 bathymetry and bottom backscatter, Knudsen 3260 subbottom.

The 2014 Survey Readiness Report can be obtained by contacting NOAA Ship *Okeanos Explorer* at ops.explorer@noaa.gov or the OER Mapping Team at oar.oer.exmappingteam@noaa.gov. The report contains calibration information, sonar specifications, and details about ancillary systems.

EX-14-02 Leg 3 Project Instructions and data management plan are available at [doi:10.7289/V5JW8BWV](https://doi.org/10.7289/V5JW8BWV).

The following data was used as background data throughout the cruise:

1) Sandwell, D. T., and W. H. F. Smith, Global marine gravity from retracked Geosat and ERS-1 altimetry: Ridge Segmentation versus spreading rate, *J. Geophys. Res.*, 114, B01411, [doi:10.1029/2008JB006008](https://doi.org/10.1029/2008JB006008), 2009.