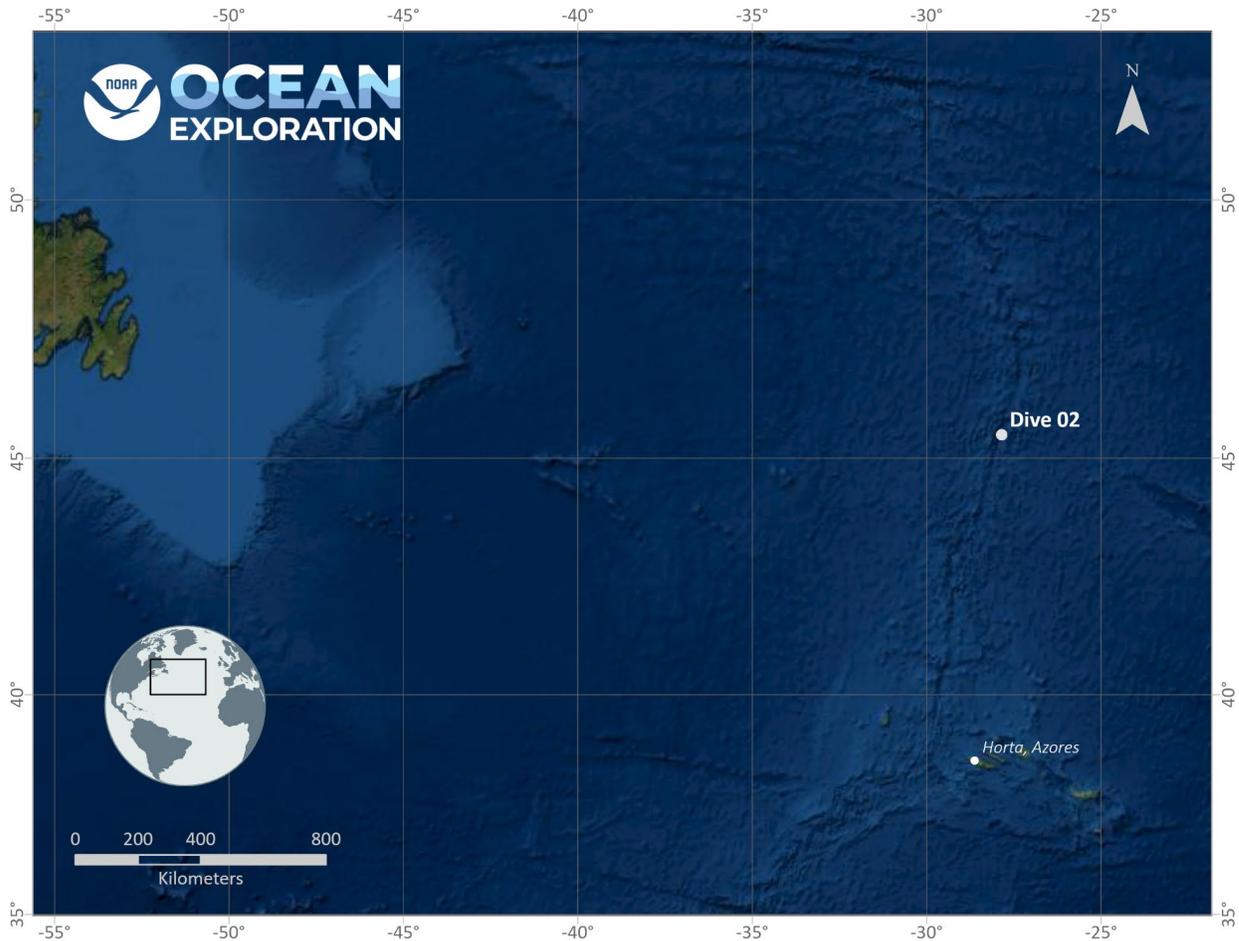


# ROV Dive Summary, EX-22-05, Dive 02

## July 21, 2022

### General Location Map



### Dive Information

Site Name	Moytirra Vent
General Area Descriptor	Mid-Atlantic Ridge
Science Team Leads	Dr. Scott France (Biology), Dr. Ashton Flinders (Geology)
Expedition Coordinator	Dr. Derek Sowers

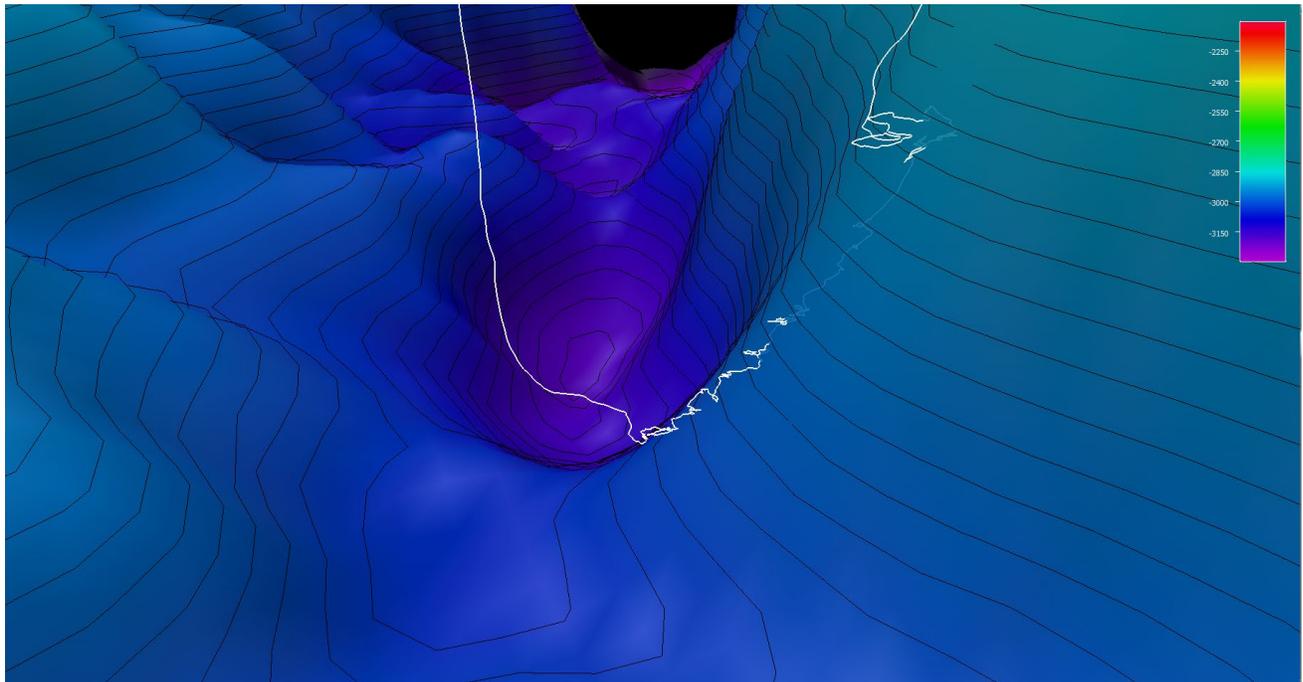


Dive Description	<p><i>Geology</i></p> <p>The dive started at what appeared to be the valley low of a large hill covered with loose, unconsolidated, sulfide/sulfate and iron oxide sediment that likely was deposited from hydrothermal venting up slope. As we proceeded up-slope we began to encounter an increasing number of various size talus blocks, most angular, in sizes ranging from a few centimeters to up to 1 meter and larger. Most appeared to be the remains of hydrothermal chimneys or hydrothermal mounds that had collapsed and fallen down slope, with a minor amount of intermixed basaltic blocks. One of the first large blocks encountered (0.5 - 1 m) was richly filled with pyrite and (or) chalcopyrite. Many of the talus blocks were crusted with green and white mineral precipitants assumed to be malachite and anhydrite (or barite). Several times along the dive we encountered small (&lt;10 cm) stalactite/mite structures covered in malachite or iron-oxide coatings. These may have been biological structures that had been crusted over. As we continued up-slope the terrain transitioned from the low angle sulfide sediment hill, to a higher angle talus field, to a steeper angle talus field with a higher concentration of basaltic rubble, covered in heavy sulfate and iron oxidation sediment, and malachite crust/veins. We observed a single, small (&lt;3 m) low effervescing hydrothermal vent, with minor black mineral precipitant ("smoke"), located precipitously on the edge of a ridge. The vent was patchwork covered in anhydrite. Upon leaving this vent and rotating the ROV to the left we observed a much larger hydrothermal vent we believe to be the "Fomorian" chimney identified in Wheeler and others (2013). This was at least 10 meters tall with distinct organ shapes and beehive diffuser structures. It was surrounded by talus of lightly weather angular basalts with no malachite or hydrothermal precipitants.</p> <p><i>Biology</i></p> <p>At the request of scientists ashore we spent much time closely examining the surface of sulfides and other rock (e.g. potential mining targets) for small megafauna that are often overlooked in surveys. On many surfaces we found skeleton shrimp (caprellid amphipods) in considerable abundance. There were many "fuzzy" rocks: rocks that had abundant small tube or mud-stick-like structures of unknown origin; one such rock was collected and the "sticks" were preserved. Other fauna included stoloniferous octocorals, scale worms, arborescent foraminifera, and a swimming elpidid holothurian. On one large outcrop we found the only large sessile non-vent fauna, a bamboo coral with associates (brittle stars, crinoid, anemone, barnacles, hydroids) and a pycnogonid sea spider. At least 4 fish species were noted: spiny eel (Notacanthidae), cutthroat eel (Synphobranchidae), roundhead grenadier (<i>Coryphaenoides</i>) and cusk eel (Ophidiidae).</p> <p>In the active vent field were well known vent-endemic fauna on and around the chimneys, including zoarcid fish (eelpouts), <i>Mirocaris</i> shrimp, <i>Peltoispira</i> limpets, and <i>Segonzacia</i> crabs.</p>
Notable Observations	Active vent chimneys with vent-endemic fauna.
Community and habitat observations	Corals and Sponges - Present Chemosynthetic Community - Present High biodiversity Community - Absent Active Seep or Vent - Present Extinct Seep or Vent - Present Hydrates - Absent
CMECS Feature Type(s)	Hydrothermal Vent Field / Slope
SeaTube Link (science annotation system)	<a href="https://data.oceannetworks.ca/SeaTubeV3?resourceTypeId=600&amp;resourceId=2573">https://data.oceannetworks.ca/SeaTubeV3?resourceTypeId=600&amp;resourceId=2573</a>

## Equipment Deployed

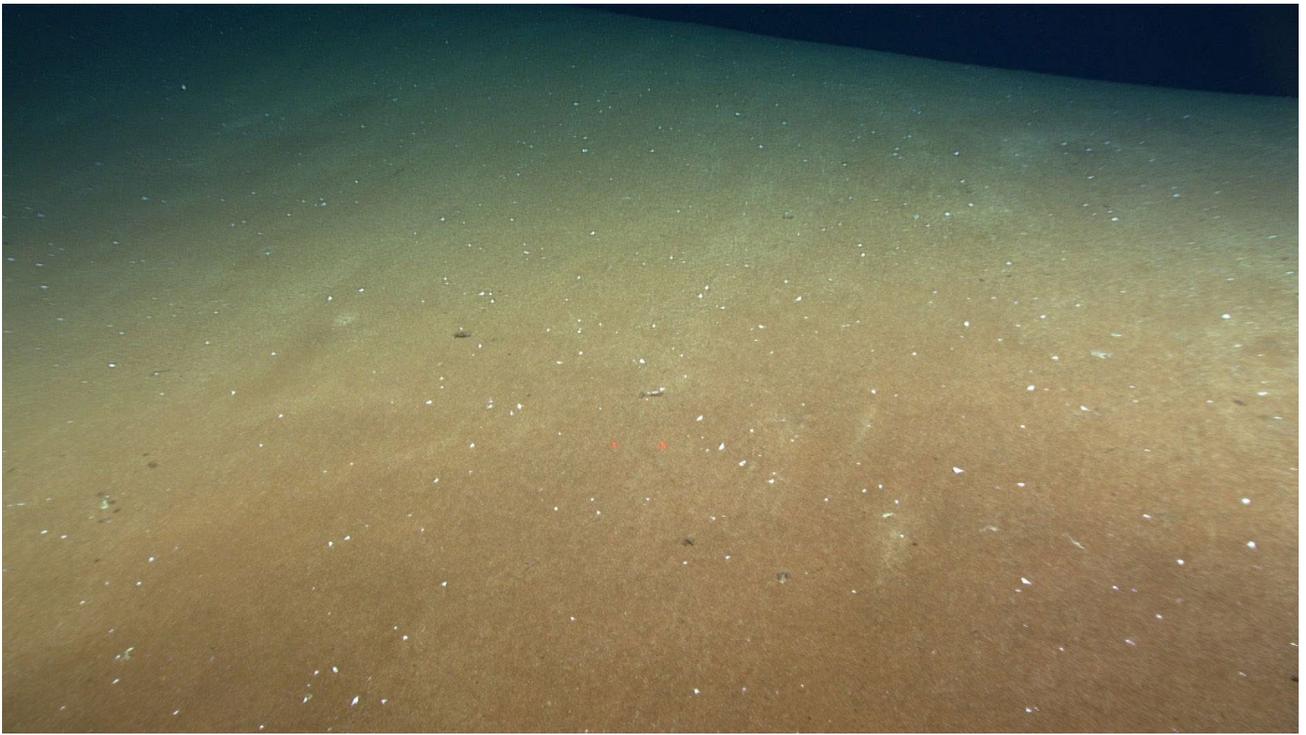
ROV	<i>Deep Discoverer</i>
Camera Platform	<i>Seirios</i>
ROV Measurements	The following ROV measurements, data streams and equipment are used on each ROV deployment: CTD, depth, scanning sonar, USBL position, altitude, heading, attitude, high-resolution cameras, low resolution cameras, manipulator arms, suction sampler, sample drawers and thrusters. The section below notes if any of these sensors were malfunctioning or not operational
Equipment Malfunctions	

## Close-up Map of Main Dive Site



Smoothed ROV dive track in white on 25x25 cell size bathymetry, 3x vertical exaggeration, depth in meters, 10 meter contours.

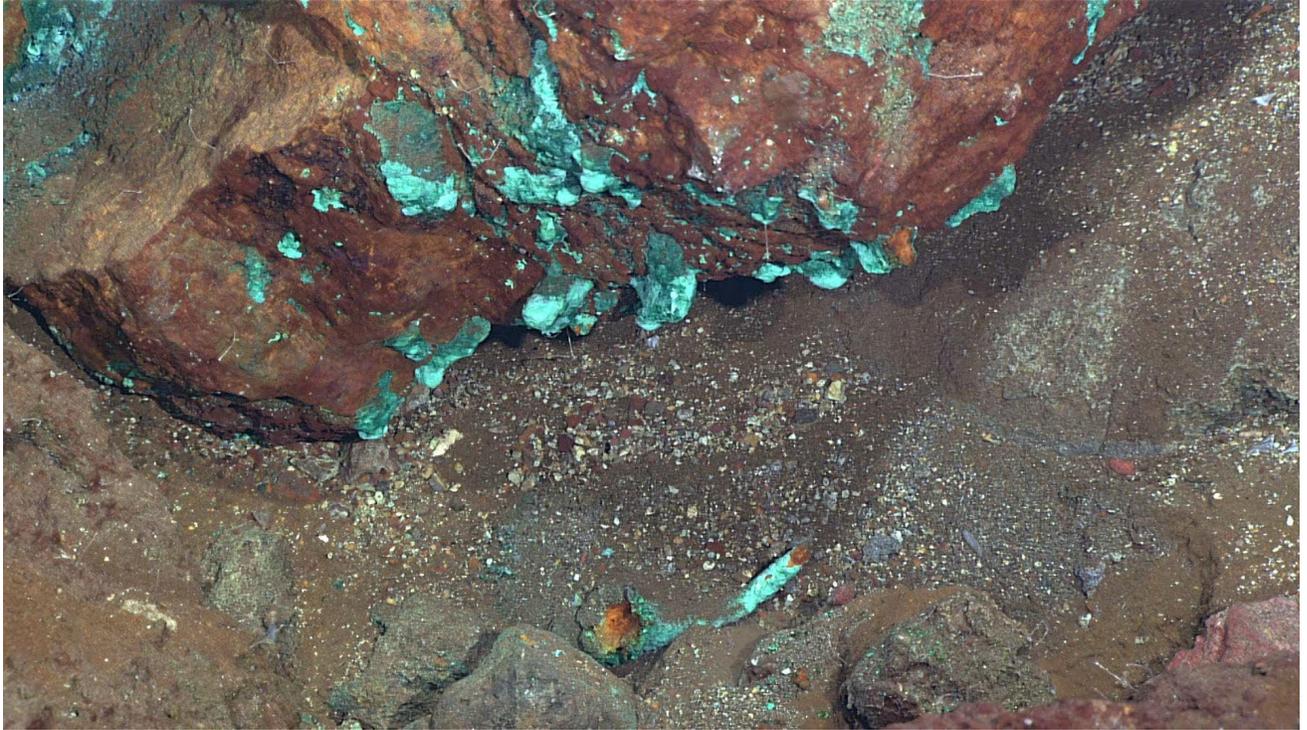
## Representative Photos of the Dive



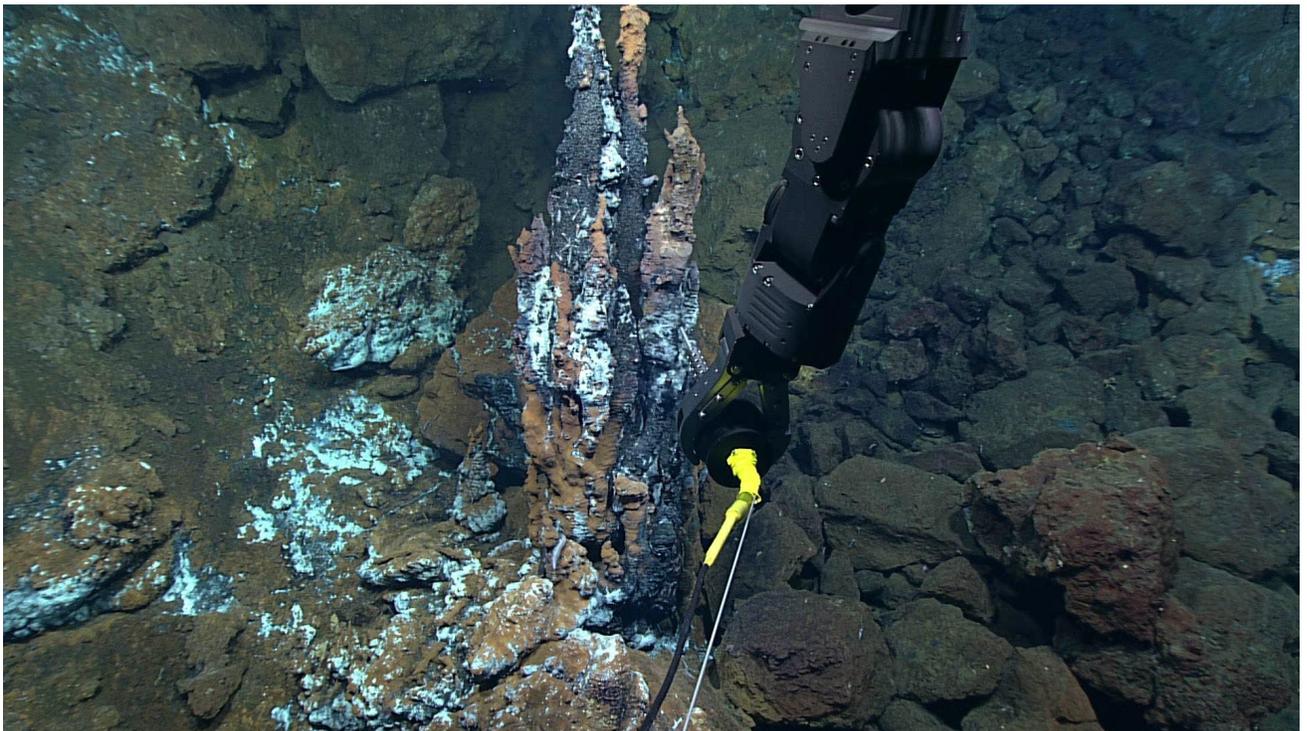
Dive starting location, pervasive hydrothermal sediment.



An ~70 cm block of a hydrothermal mound with heavy concentrations of pyrite/chalcopyrite.



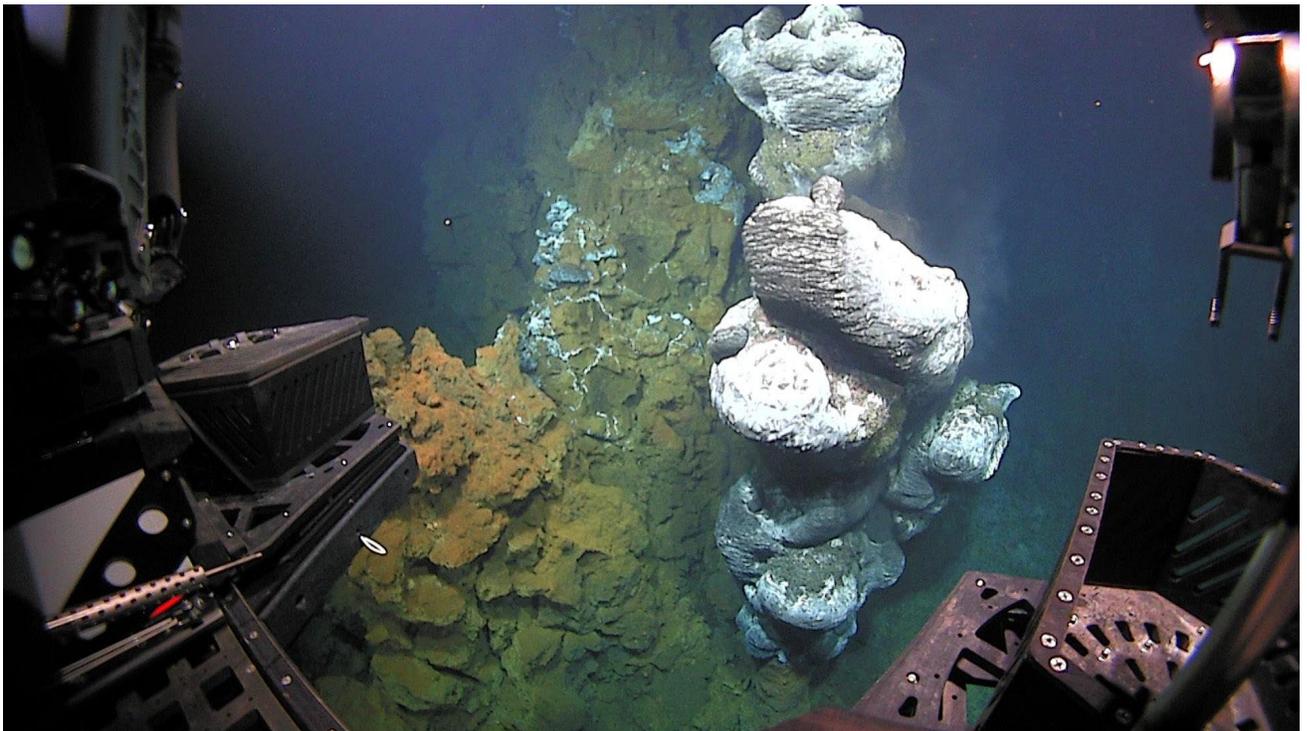
What appears to be a heavily oxidized basaltic block with partial copper carbonate precipitate coating.



A low temperature (~50C) hydrothermal vent.



Inactive hydrothermal chimney field.



What we believe was the “Fomorani” chimney described by a previous expedition, with characteristic organ shape and beehive diffuser structures.



Several skeleton shrimp (Caprellidae) on the surface of rocks in the inactive field.

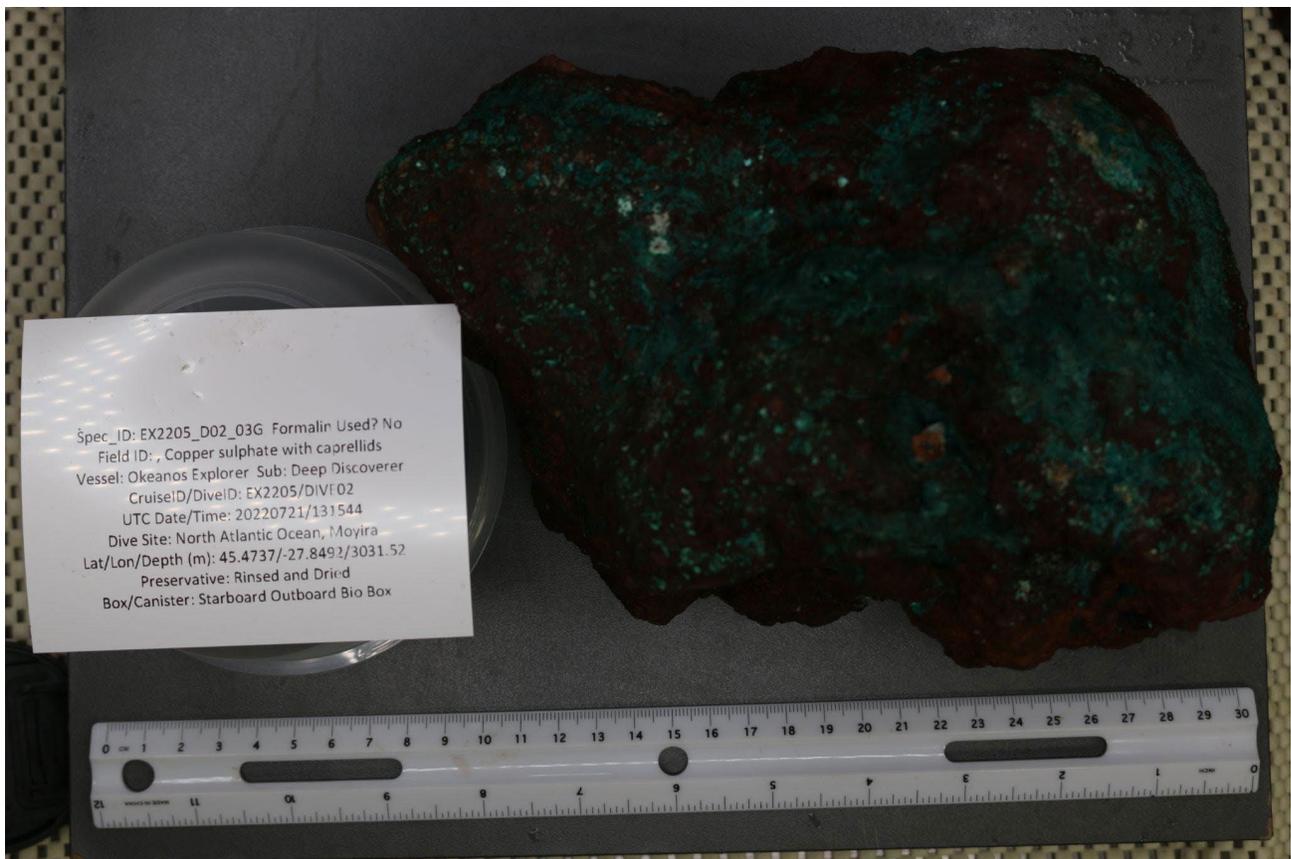


"Fuzzy" rock with tubes of unknown origin, amphipods, foraminifera, and stoloniferous octocorals.



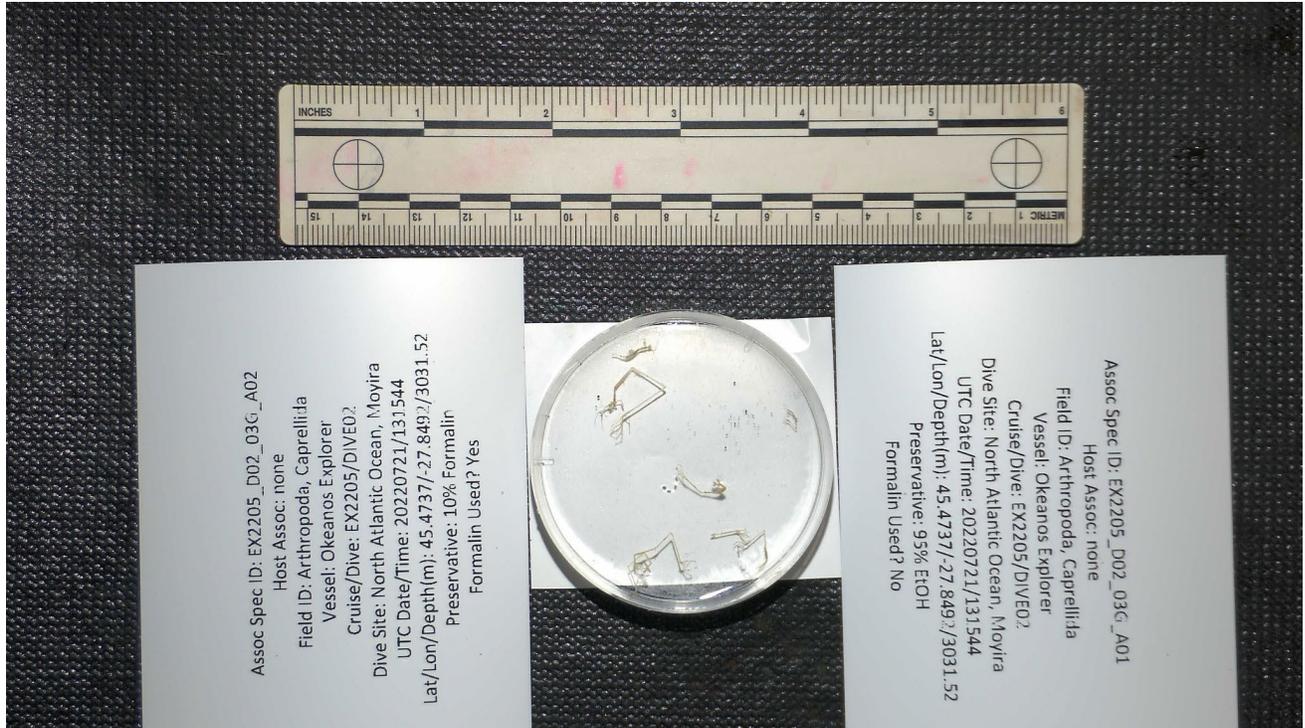
Vent endemic eelpout (Zoarcidae).

## Samples Collected -



Sample ID	EX2205_D02_03G
Date (UTC)	20220721

Time (UTC)	13:15:44
Depth (m)	3031.50
Latitude (decimal degrees)	45.474
Longitude (decimal degrees)	-27.849
Temp. (°C)	3.49
Field ID(s)	Copper sulfate with caprellids
Comments	Angular talus with rounded corner; heavy; likely basalt, 20% malachite coating. Malachite is micro-crystalline, small < 3 mm pockets of pyrite or chalc pyrite. Malachite coating is sub-mm thickness, identified through color alone. Possible chlorite, heav



Associates Sample ID	Field Identification	Count
EX2205_D02_03G_A01	Caprellida	3
EX2205_D02_03G_A02	Caprellida	5



Sample ID	EX2205_D02_04G
Date (UTC)	20220721
Time (UTC)	13:50:34
Depth (m)	3015.90
Latitude (decimal degrees)	45.474
Longitude (decimal degrees)	-27.849
Temp. (°C)	3.50
Field ID(s)	Unidentified anhydrite
Comments	Sharp angular clast, approx 12 x 5 x 5 cm. Dark to light gray ground mass with 0.5 - 7 mm light gray white angular, highly weathered and bleached phenocrysts. Likely a highly altered and bleached ultramafic xenolith. Small < 10 malachite pieces studded on



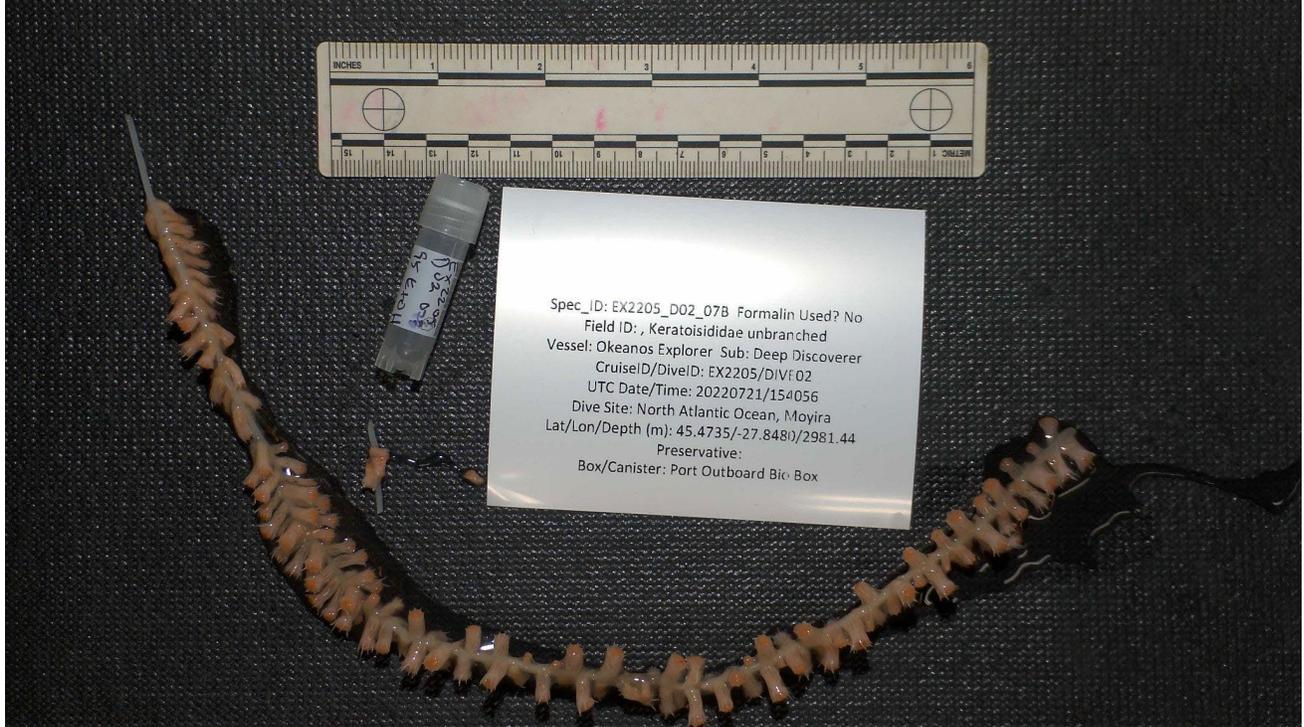
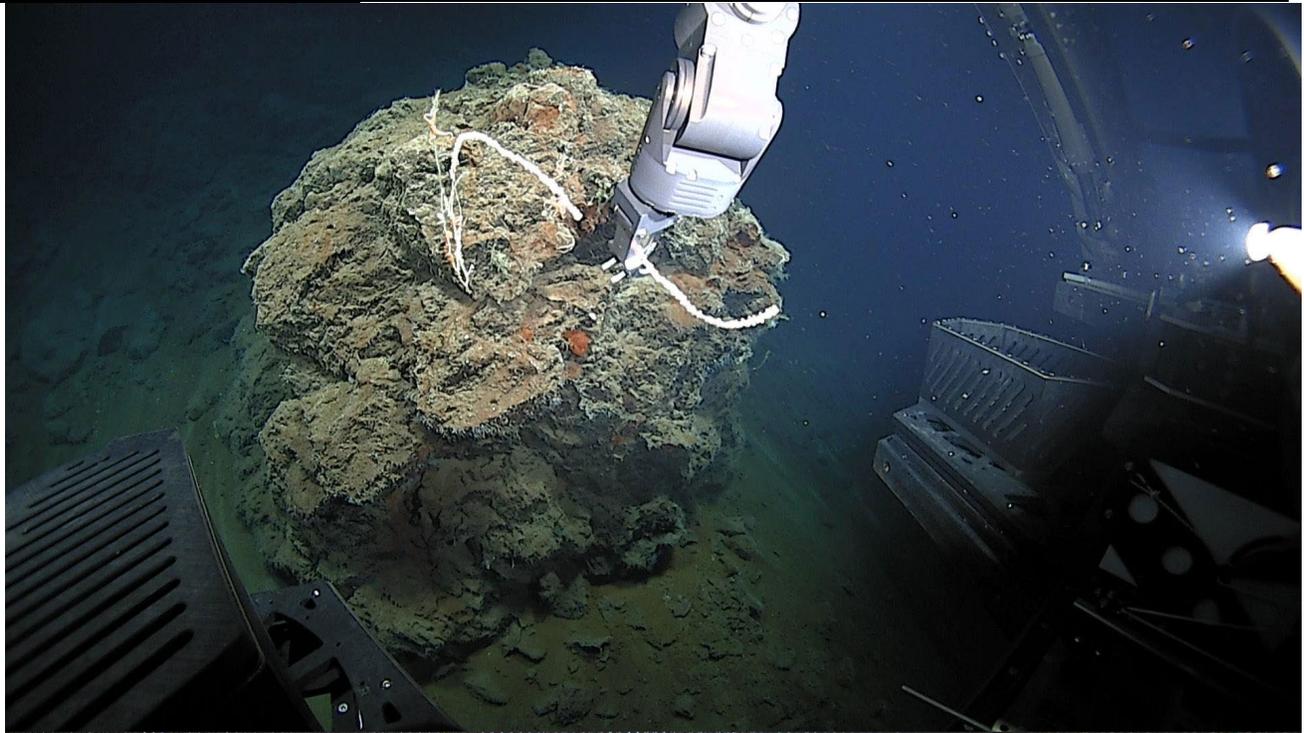
Sample ID	EX2205_D02_05G
Date (UTC)	20220721
Time (UTC)	14:02:46
Depth (m)	3011.779
Latitude (decimal degrees)	45.4732
Longitude (decimal degrees)	-27.8486
Temp. (°C)	3.48
Field ID(s)	Rock
Comments	Rounded talus; heavy; likely basalt, 40% malachite coating. Malachite is micro-crystalline, occasional calcite crystals. White precipitate mat covering 5%. < 4 mm encrustations of pyrite or chalcopryite. Malachite coating is sub-mm thickness, identified t

Associates Sample ID	Field Identification	Count
EX2205_05G_A01	Caprellida	1



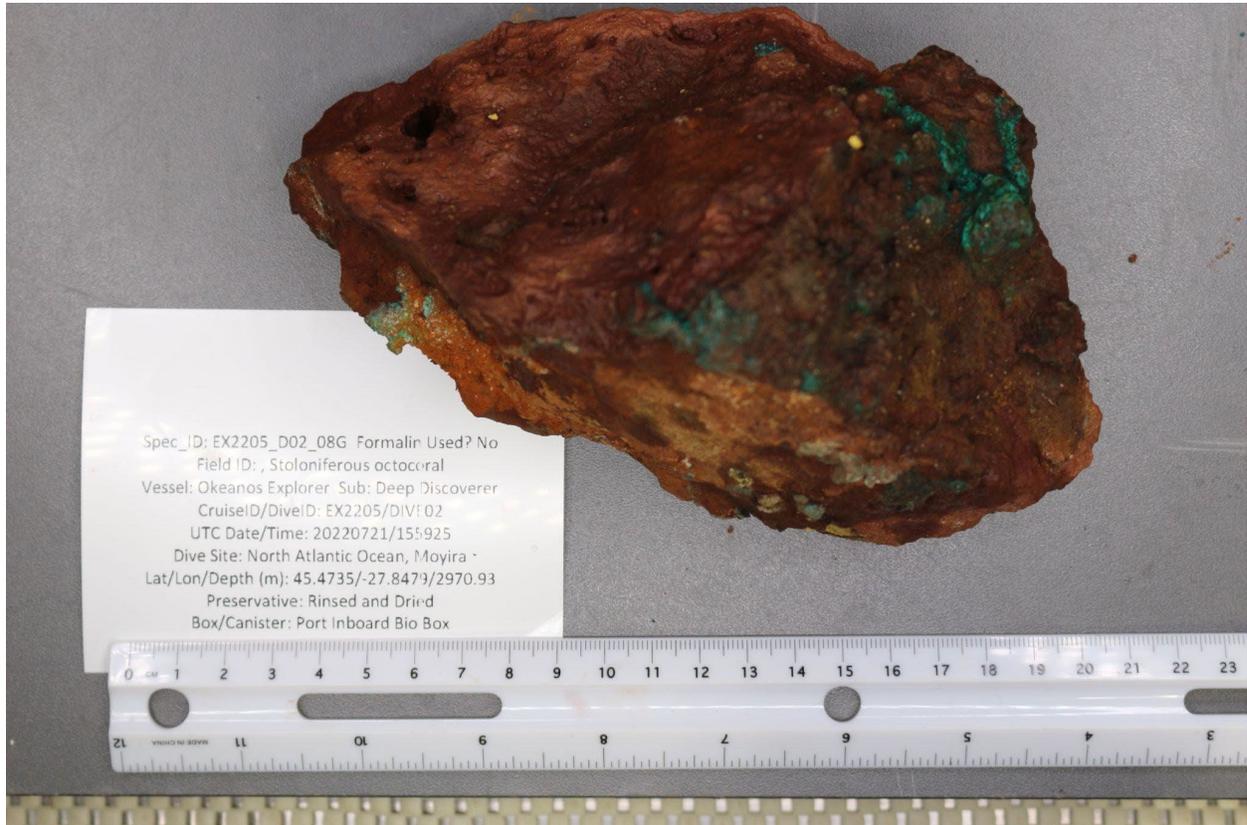
Sample ID	EX2205_D02_06G
Date (UTC)	20220721
Time (UTC)	14:35:04
Depth (m)	3002.70
Latitude (decimal degrees)	45.474
Longitude (decimal degrees)	-27.848

Temp. (°C)	3.50
Field ID(s)	Rusticle
Comments	2 vials



Sample ID	EX2205_D02_07B
Date (UTC)	20220721
Time (UTC)	15:40:56

Depth (m)	2981.40
Latitude (decimal degrees)	45.473
Longitude (decimal degrees)	-27.848
Temp. (°C)	3.48
Field ID(s)	Keratoisididae unbranched
Comments	Very slimy



Sample ID	EX2205_D02_08G
Date (UTC)	20220721
Time (UTC)	15:59:25
Depth (m)	2970.90
Latitude (decimal degrees)	45.474
Longitude (decimal degrees)	-27.848
Temp. (°C)	3.48
Field ID(s)	basalt talus (field ID shown on label is incorrect)
Comments	Angular basalt talus. Size is 18 x 10 x 10 cm. 3% vesicularity, most vesicles 1-2 mm, a vesicle up 1 cm. Covered in oxide coating. One side

slightly rounded with 7 x 1 cm Malachite precipitant. Same surface has minor pyrite or chalcopyrite.



Assoc Spec ID: EX2205\_D02\_08G\_A03  
 Host Assoc: none  
 Field ID: Annelida,  
 Vessel: Okeanos Explorer  
 Cruise/Dive: EX2205/DIVE02  
 Dive Site: North Atlantic Ocean, Moyira  
 UTC Date/Time: 20220721/15:5925  
 Lat/Lon/Depth(m): 45.4735/-27.8479/2970.93  
 Preservative: 95% EtOH  
 Formalin Used? No

Assoc Spec ID: EX2205\_D02\_08G\_A04  
 Host Assoc: none  
 Field ID: Annelida,  
 Vessel: Okeanos Explorer  
 Cruise/Dive: EX2205/DIVE02  
 Dive Site: North Atlantic Ocean, Moyira  
 UTC Date/Time: 20220721/15:5925  
 Lat/Lon/Depth(m): 45.4735/-27.8479/2970.93  
 Preservative: 10% Formalin  
 Formalin Used? Yes

Associates Sample ID	Field Identification	Count
EX2205_D02_08G_A01	Octocorallia	1
EX2205_D02_08G_A03	Annelida	13



Spec\_ID: EX2205\_D02\_10G  
 Field No.:  
 Vessel:  
 Date/Time: 20220721/17:26:36  
 Dive Site: North Atlantic Ocean, Midway  
 Lat/Lon/Depth (m): 45.4733/-27.8484/2922  
 Preservation: Rinsed and Dried  
 Box/Container: Starboard Forward Rack B

Sample ID	EX2205_D02_10G
Date (UTC)	20220721
Time (UTC)	17:26:36
Depth (m)	2922.50
Latitude (decimal degrees)	45.473
Longitude (decimal degrees)	-27.848
Temp. (°C)	3.48
Field ID(s)	Basalt with iron-oxide coating
Comments	Basalt talus, < 1% vesicularity. Vesicles 0.75 mm. Dense. Looks like 1 surface fractured in series of parallel planes; might be outer cooling surface of pillow or toothpaste floe. Same surface has small 5 x 2 cm patch weathered glass.

### Niskin Sampling Summary

Sample ID	EX2205_D02_01W
Date (UTC)	20220721
Time (UTC)	11:16:01
Depth (m)	1537.27

Latitude (decimal degrees)	45.4742
Longitude (decimal degrees)	-27.849
Bottle number	NISKIN 1
Temperature (°C)	4.324
Dissolved Oxygen (ml/L)	11.56
Treatment	eDNA

Sample ID	EX2205_D02_02W
Date (UTC)	20220721
Time (UTC)	12:14:19
Depth (m)	3038.48
Latitude (decimal degrees)	45.4736
Longitude (decimal degrees)	-27.8499
Bottle number	NISKIN 2
Temp. (°C)	3.57
Dissolved Oxygen (ml/L)	23.
Treatment	eDNA

Sample ID	EX2205_D02_03W
Date (UTC)	20220721
Time (UTC)	17:18:57
Depth (m)	2942.18
Latitude (decimal degrees)	45.4734
Longitude (decimal degrees)	-27.8480
Bottle number	NISKIN 3
Temp. (°C)	3.48
Dissolved Oxygen (ml/L)	26.17
Treatment	eDNA

Sample ID	EX2205_D02_09W
Date (UTC)	20220721

Time (UTC)	17:18:57
Depth (m)	2942.20
Latitude (decimal degrees)	45.473
Longitude (decimal degrees)	-27.848
Bottle number	NISKIN 4
Temperature (°C)	3.48
Dissolved Oxygen (ml/L)	26.17
Treatment	eDNA

Sample ID	EX2205_D02_11W
Date (UTC)	20220721
Time (UTC)	17:28:56
Depth (m)	2907.30
Latitude (decimal degrees)	45.473
Longitude (decimal degrees)	-27.848
Bottle number	NISKIN 5
Temperature (°C)	3.54
Dissolved Oxygen (ml/L)	25.72
Treatment	eDNA

Sample ID	EX2205_D02_12W
Date (UTC)	20220721
Time (UTC)	18:57:47
Depth (m)	403.10
Latitude (decimal degrees)	45.473
Longitude (decimal degrees)	-27.849
Bottle number	NISKIN 6
Temperature (°C)	12.54
Dissolved Oxygen (ml/L)	7.23
Treatment	eDNA

## Scientists Involved

Name	Email	Affiliation
Les Watling	watling@hawaii.edu	University of Hawaii at Manoa
Michael Vecchione	vecchiom@si.edu	NOAA and Smithsonian NMNH
Cindy Van Dover	clv3@duke.edu	Duke University
Ken Sulak	Jumpingsturgeon@yahoo.com	USGS
Arvind Shantharam	arvind.shantharam@noaa.gov	NGI/NCEI
Tim Shank	tshank@whoi.edu	Woods Hole Oceanographic Institution
Manuela Ramos	manuramo@gmail.com	OKEANOS/IMAR
Elisabetta Menini	elisabetta.menini@duke.edu	Duke University
Asako Matsumoto	amatsu@gorgonian.jp	Chiba Institute of Technology
Ashley Marranzino	ashley.marranzino@noaa.gov	NOAA (UCAR)
Christopher Mah	brisinga@gmail.com	National Museum of Natural History-Smithsonian
Alaina Hebert	c00241285@louisiana.edu	University of Louisiana at Lafayette
Tara Harmer Luke	tara.luke@stockton.edu	Stockton University
Upasana Ganguly	upasana.ganguly1@louisiana.edu	University of Louisiana at Lafayette
Scott France	scott.france@louisiana.edu	University of Louisiana at Lafayette
Ashton Flinders	aflinders@usgs.gov	USGS
Carlos Dominguez-Carrió	carlosdominguezcarrio@gmail.com	University of the Azores
Mary Deere	mary.deere1@louisiana.edu	University Louisiana at Lafayette
Daphne Cuvelier	daphne.cuvelier@gmail.com	Institute of Marine Sciences - Okeanos, University of the Azores
Ana Colaço	maria.aa.colaco@uac.pt	Okeanos-University of Azores
Nolan Barrett	barrettnh56@gatech.edu	Georgia Institute of Technology
Jaymes Awbrey	C00227433@louisiana.edu	University of Louisiana at Lafayette
Allen Collins		Smithsonian NMNH
Thomas Morrow	thomas.morrow@noaa.gov	NOAA
Dhugal Lindsay	dhugal@jamstec.go.jp	JAMSTEC
Ellen Kenchington	Ellen.Kenchington@dfo-mpo.gc.ca	DFO
Julie Huber	jhuber@whoi.edu	WHOI
Deb Glickson	dglickson@nas.edu	National Academies of Sciences, Engineering, and Medicine
Deidric Davis	dbdavis@eckerd.edu	DUML
Patrick Collins	patrick.collins@qub.ac.uk	QUB

**Please direct inquiries to:**

NOAA Office of Ocean Exploration & Research

1315 East-West Highway, SSMC3 RM 10210

Silver Spring, MD 20910

[oceanexplorer@noaa.gov](mailto:oceanexplorer@noaa.gov)

