Applying a Standardized Classification Scheme (CMECS) to Multibeam Sonar and ROV Video Data on Gosnold Seamount

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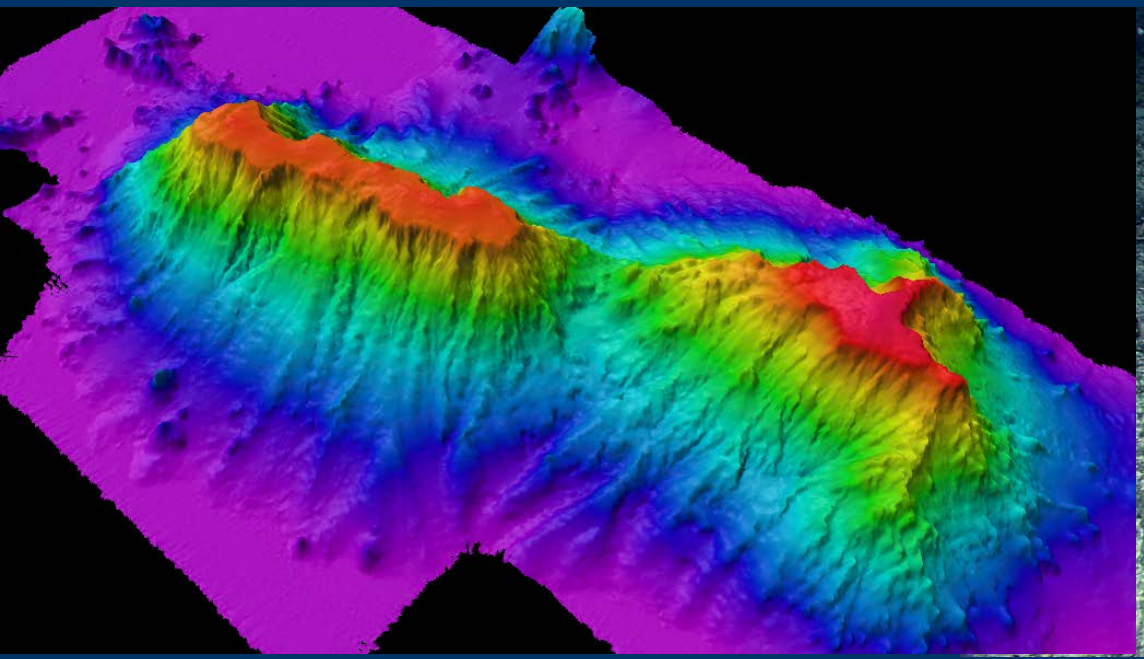
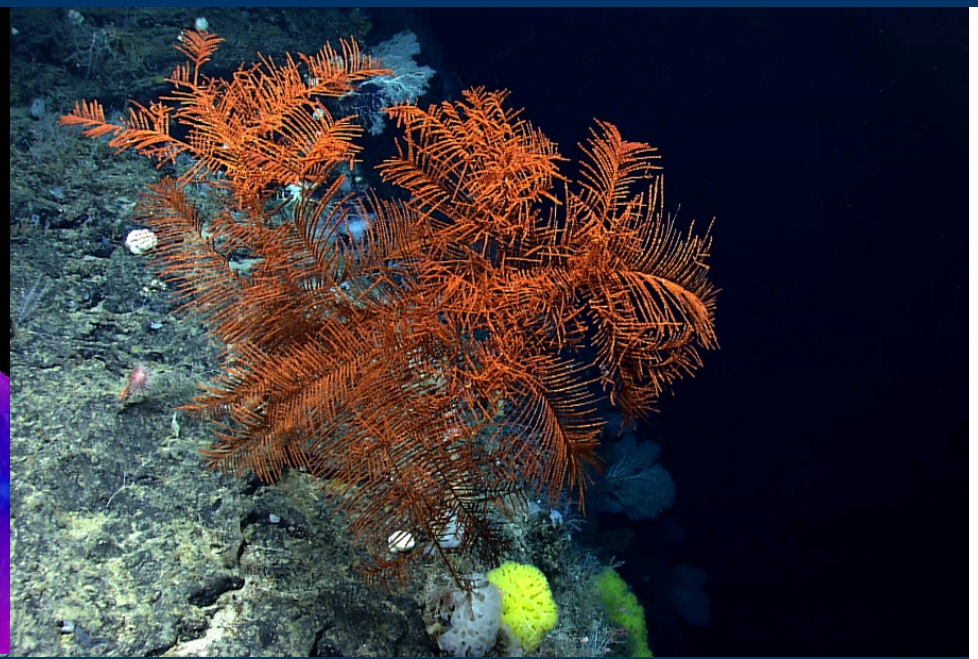
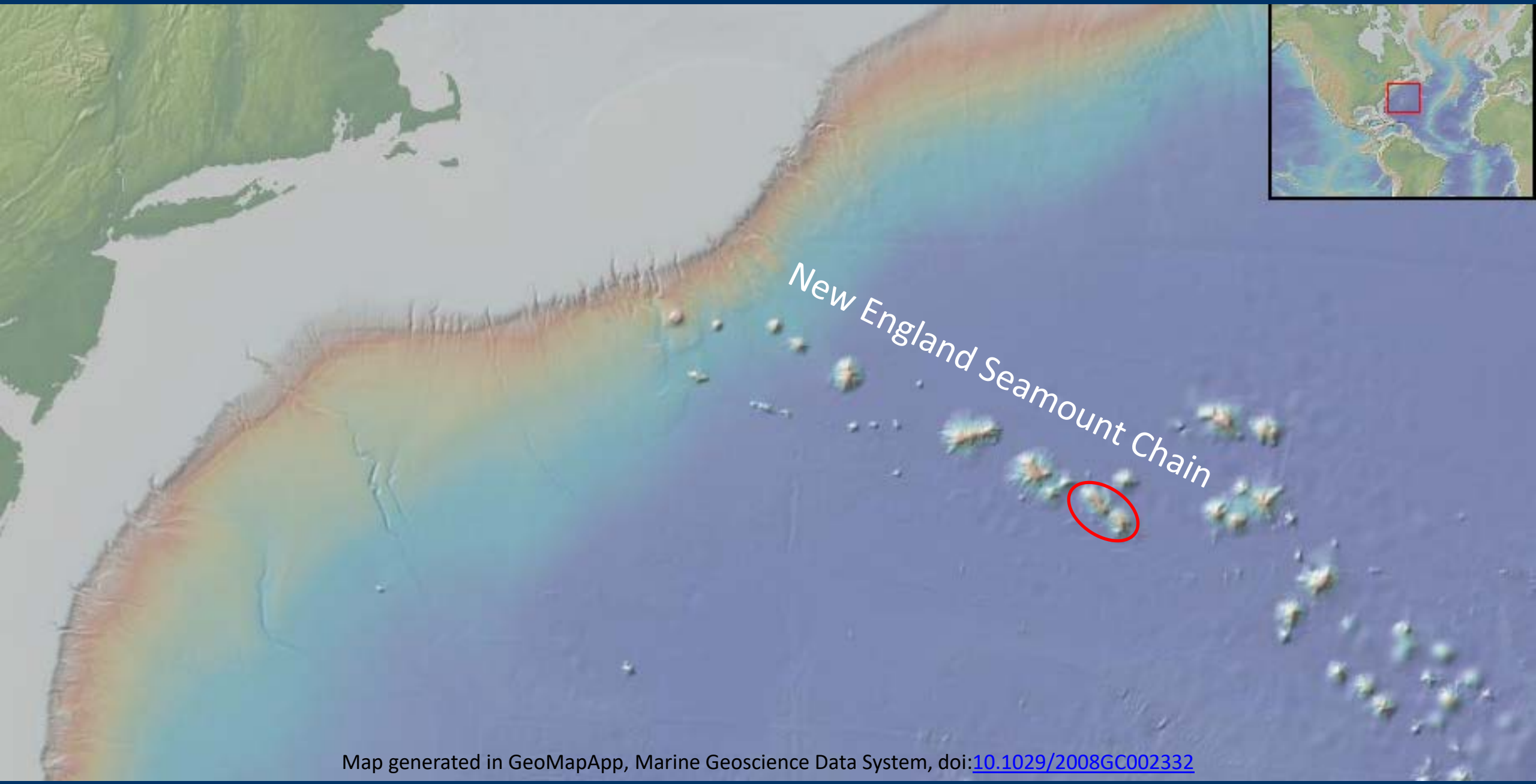
Ocean Exploration and Research





CMECS
Coastal & Marine Ecological Classification Standard

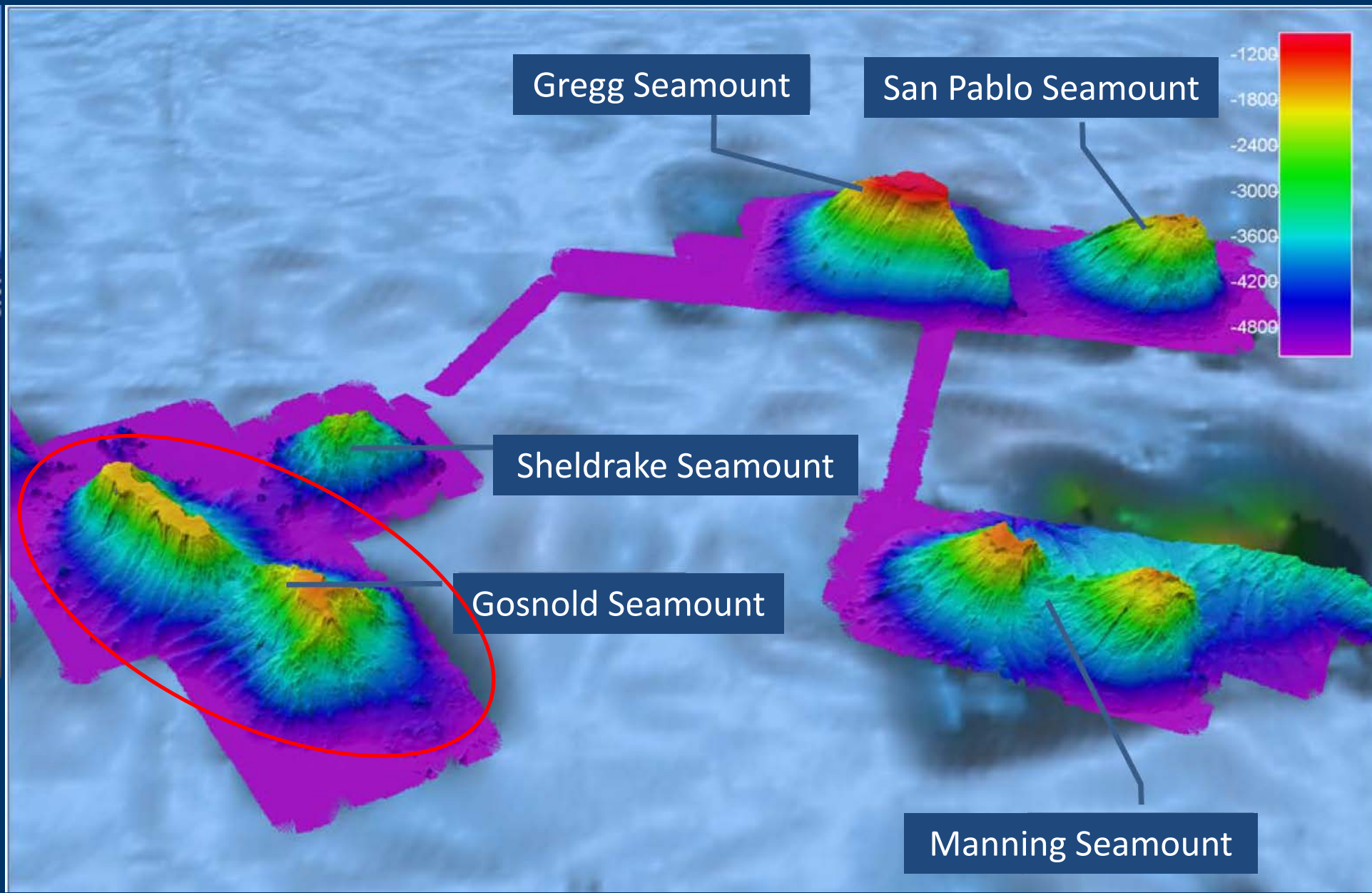
Study Area: Gosnold Seamount



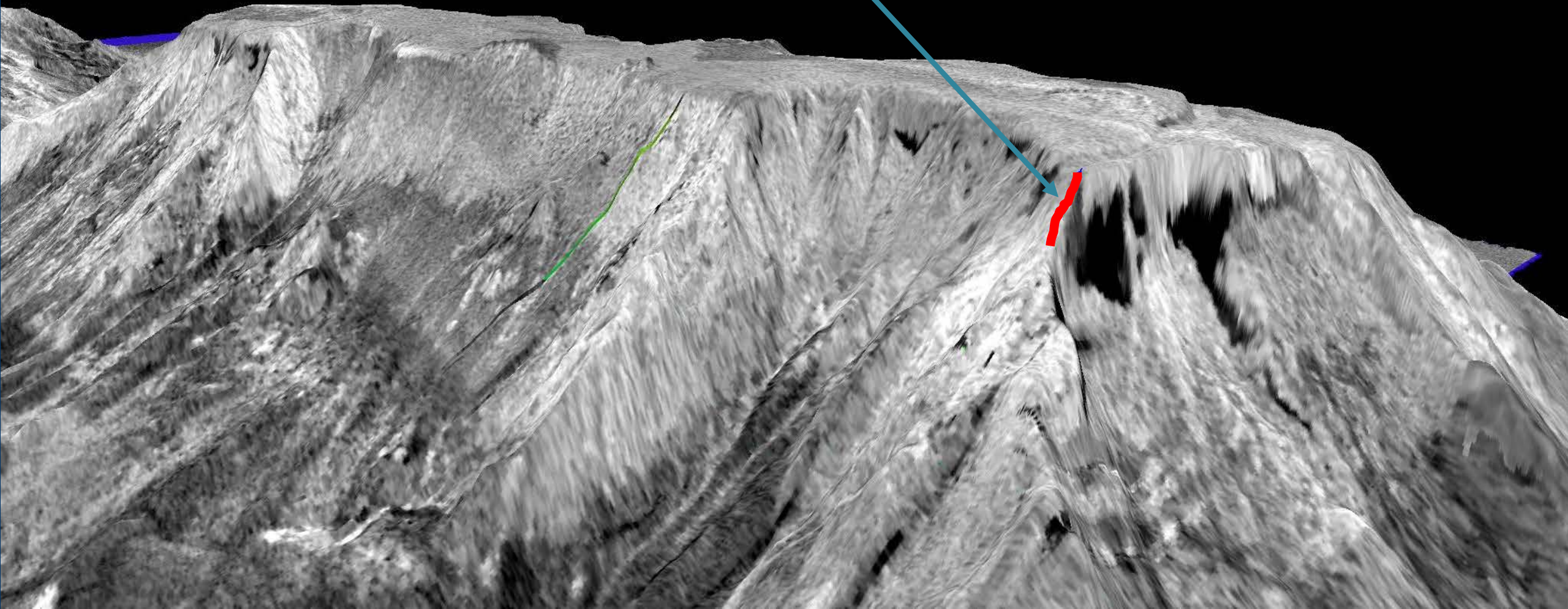
Map generated in GeoMapApp, Marine Geoscience Data System, doi:10.1029/2008GC002332

First detailed mapping survey and ROV dive on Gosnold Seamount done in 2014 by NOAA's Office of Ocean Exploration & Research

EM302
Multibeam Sonar



ROV Exploration Dive



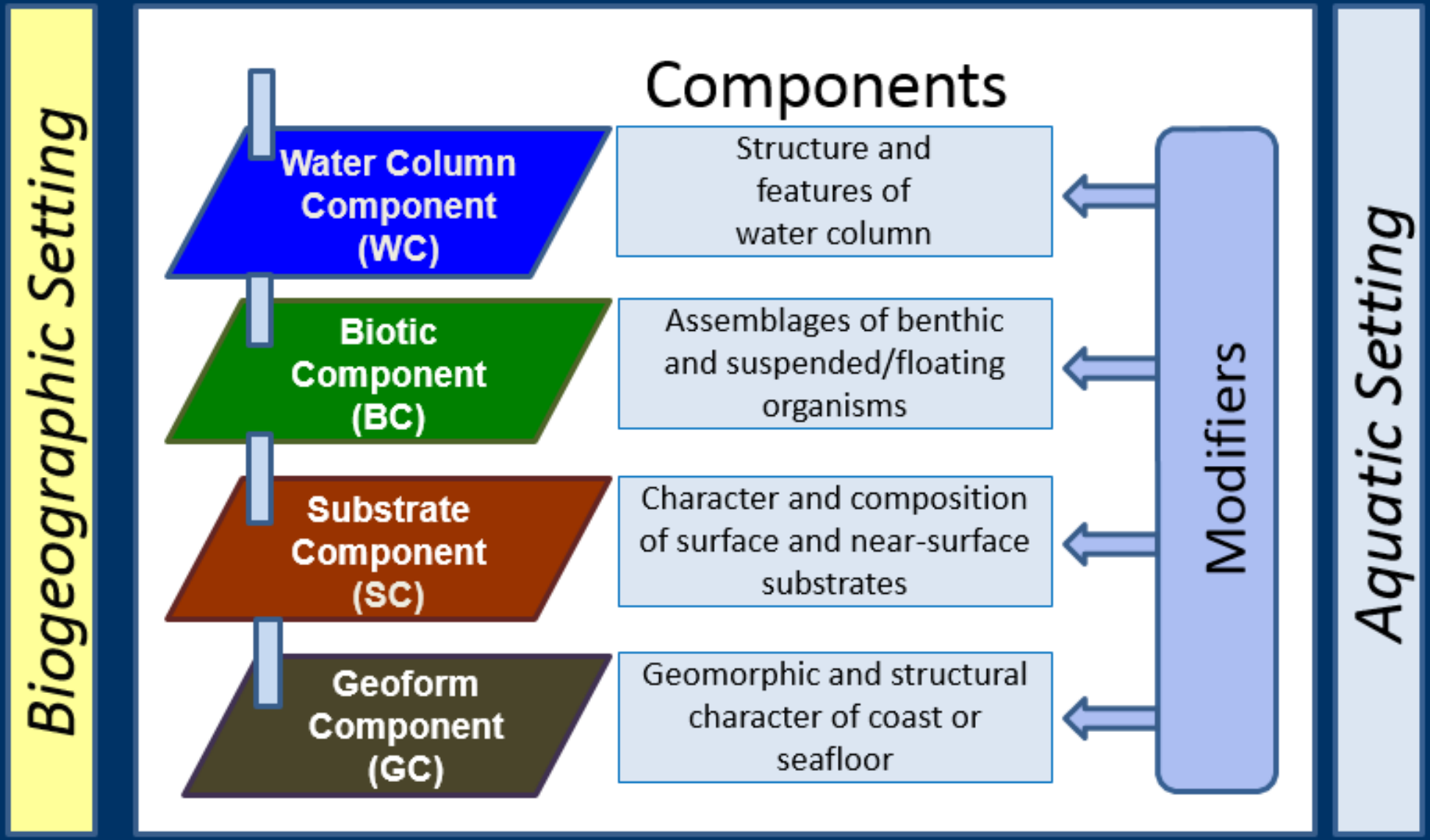
Research Objectives

1) Apply practical, repeatable application of a standardized classification scheme (CMECS) to a deep sea feature using multibeam sonar and ROV video data as inputs.

2) Employ new methods of annotation and interpretation of ROV video data for substrate and biological community classification.

3) Further refine new semi-automated method for seafloor classification (BRESS) utilizing information from both bathymetry and backscatter data (Masetti et al., Geosciences 2018, 8, 14; doi:10.3390)

Coastal and Marine Ecological Classification Standard (CMECS): a common language to describe coastal and marine ecological features



CMECS Classification of Gosnold Seamount – Upper Hierarchy

Biogeographic Setting:

- Realm: Temperate Northern Atlantic
- Province: Cold Temperate Northwest Atlantic
- Ecoregion: n/a (not defined outside national maritime boundaries)

Aquatic Setting:

- System: Marine
- Subsystem: Marine Oceanic
- Tidal Zone: Subtidal

Water Column Component:

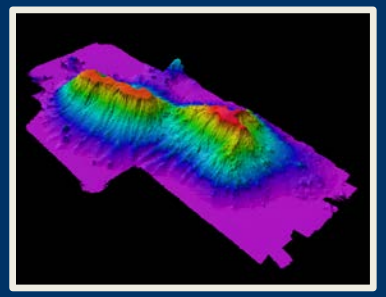
- Water Column Layer: Marine Oceanic
- Salinity Regime: Euhaline Water (30 to <40 PSU)
- Temperature Regime: Very Cold (0 to <5 degrees C)

Geoform Component:

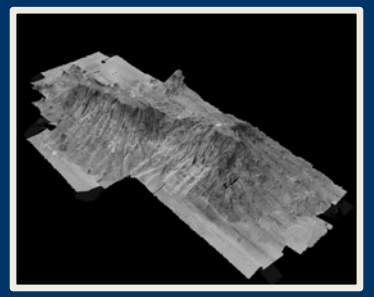
- Tectonic Setting: Abyssal Plain
- Physiographic Setting: Marine Basin Floor
- Geoform Origin: Geologic
- Level 1 Geoform: Seamount, Geoform Type: Guyot

Analysis of Multibeam Sonar Data

Bathymetry



Backscatter



BRESS
(Bathymetry and Reflectivity-based Estimator for Seafloor Segmentation)

Segments
- Landform mask
- Backscatter histogram analysis
- Splitting/merging

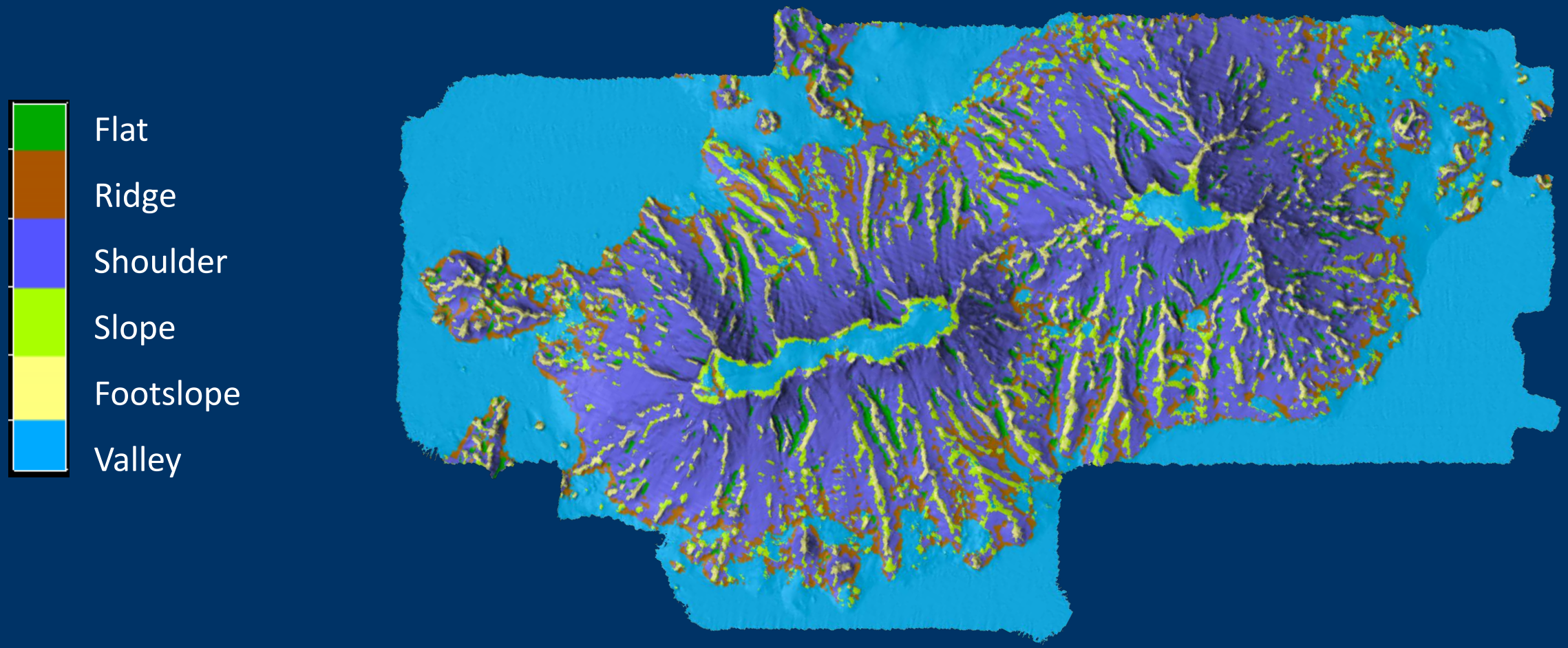
Landforms
- Flat
- Slope
- Shoulder
- Footslope
- Ridge
- Valley

Guidance on sediment groundtruth sampling

Predicted CMECS Substrate (?)

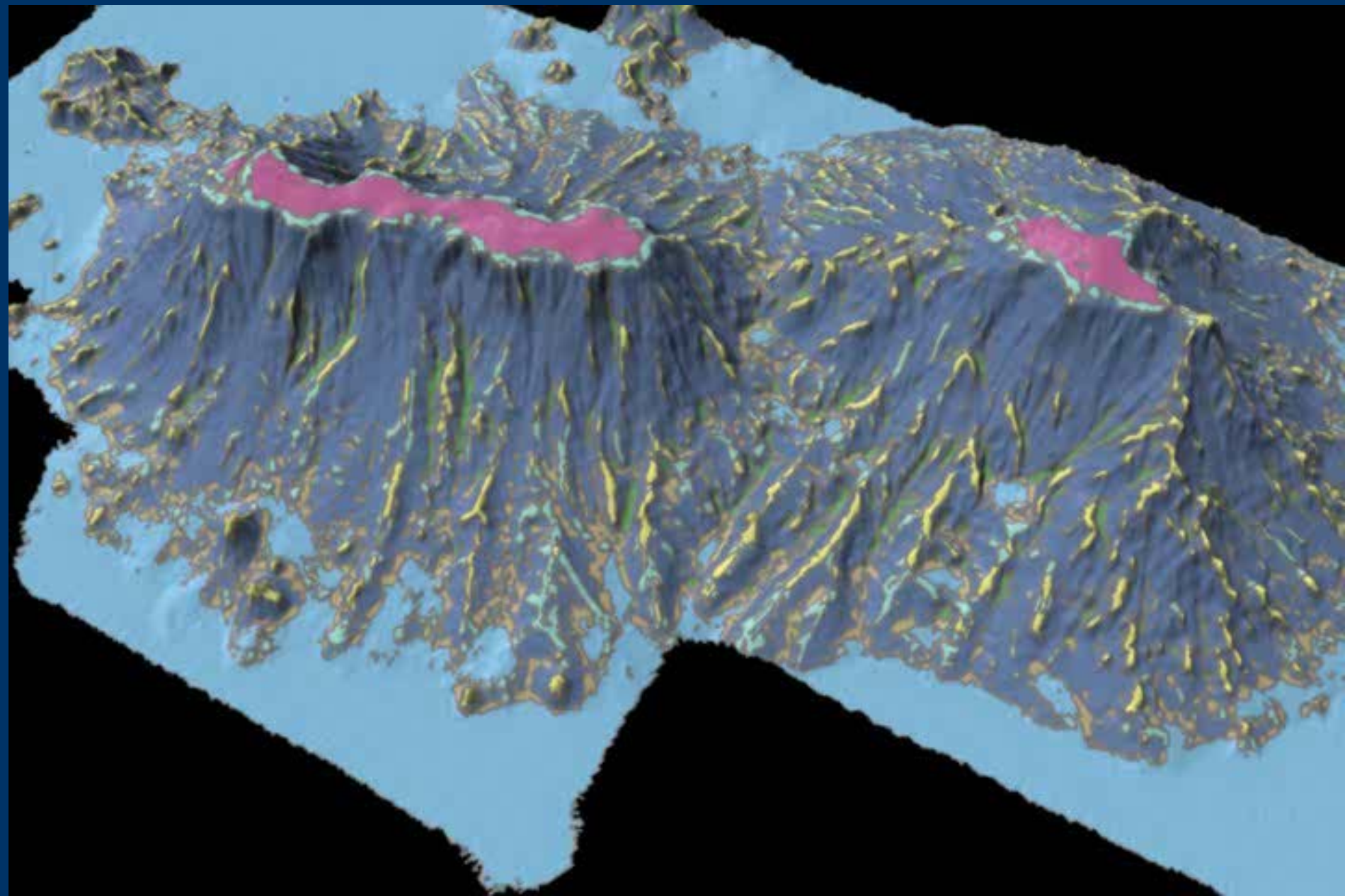
CMECS Geoforms

Results: Landforms Based on “geomorphons”



Results: CMECS Geoforms

- Flat
- Ridge
- Shoulder
- Slope
- Footslope
- Valley
- Guyot Flat

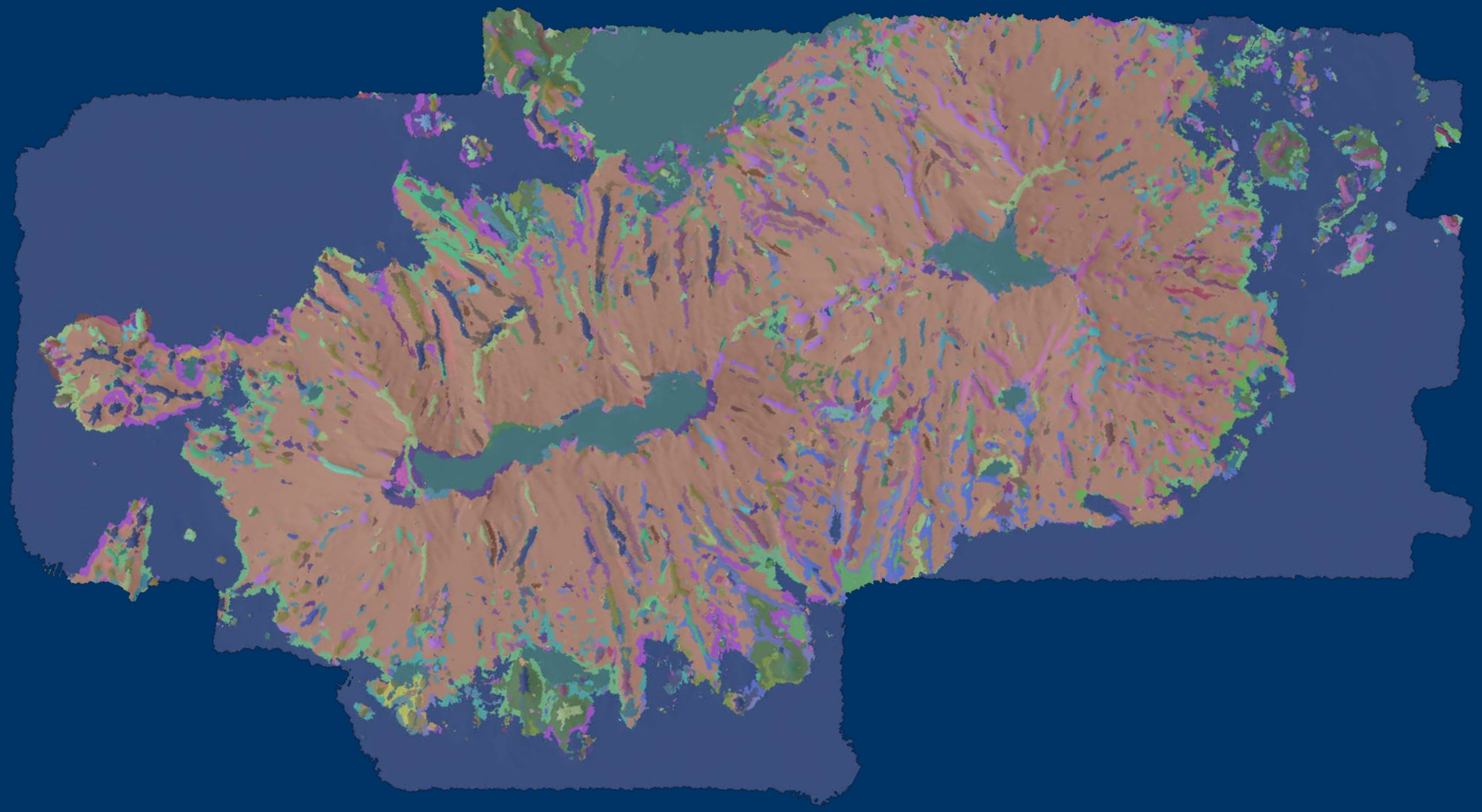


CMECS Geoform Classes

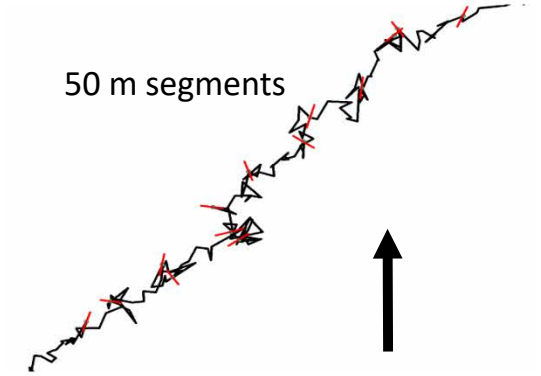
Tectonic Setting	Physiographic Setting	Geoform Origin	Geoform	Geoform Type
Abyssal Plain	Marine Basin Floor	Geologic	Seamount	Guyot
			Flat	Provisional: Guyot Flat, Provisional: Abyssal Floor
			Ridge	Provisional: Seamount Ridge
			Slope	Provisional: Seamount Slope
			Provisional Unit: Valley	Provisional: Seamount Valley
			Provisional Unit: Shoulder	Provisional: Seamount Shoulder
			Provisional Unit: Footslope	Provisional: Seamount Footslope

Results: Segmentation Output from BRESS

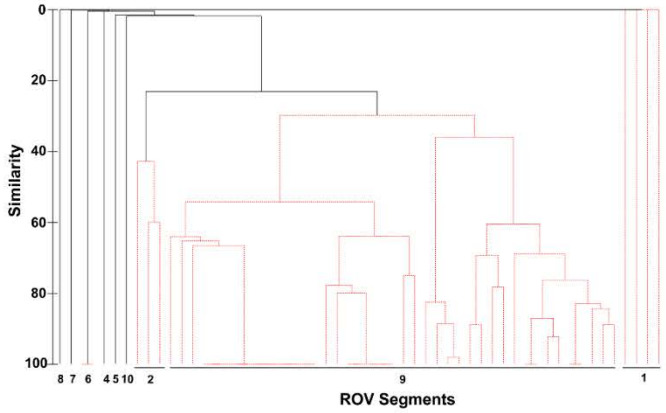
- Landforms of similar acoustic response grouped together
- Informs sediment sampling approach
- Future work to assign predicted sediment types

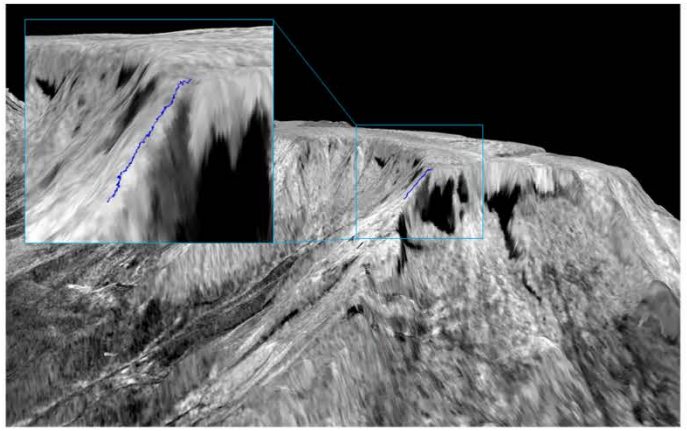


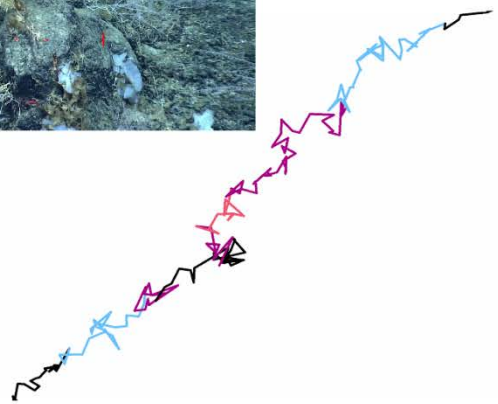
Analysis of ROV Video Data



Cluster Analysis



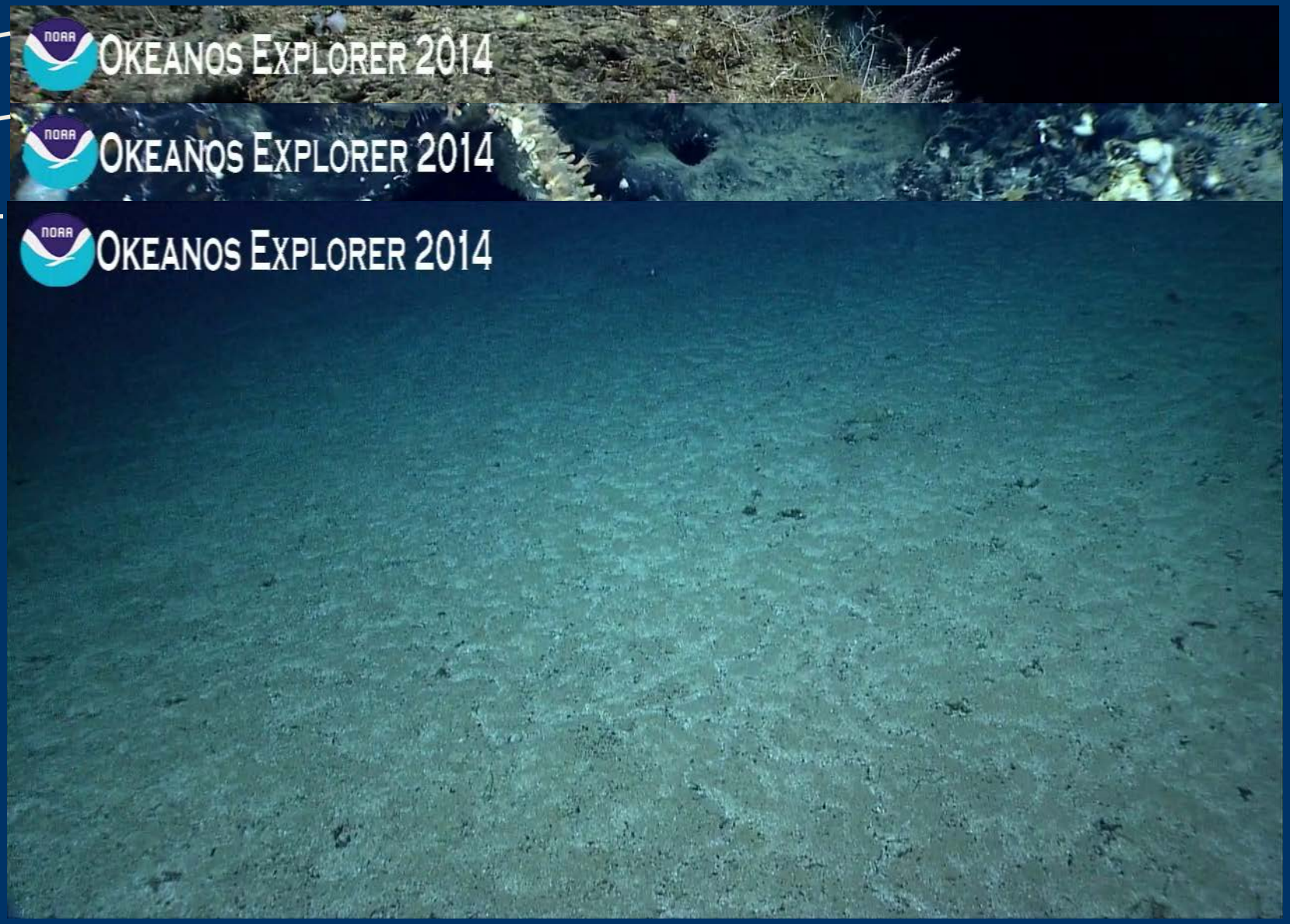




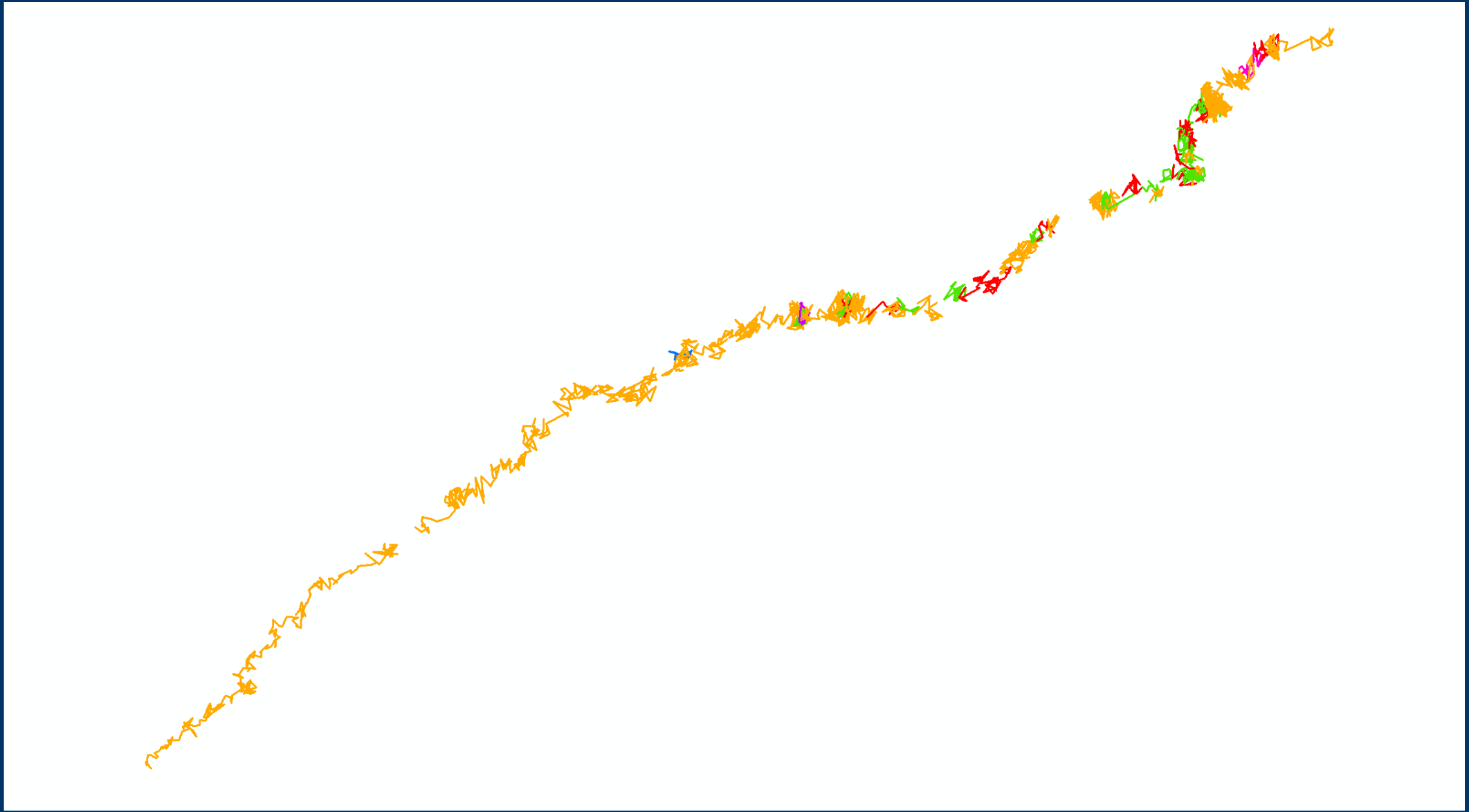
Classified substrate along each 50m transect using CMECS substrate classes

Substrate Classes:

- Bedrock
- Coral Rubble
- Sand
- Bedrock (Primary) / Fine_Unconsolidated (Secondary)



Similarity of Biological Community Composition Along ROV Track



Lessons Learned Thus Far:

- Automated segmentation effective at generating useful landform and acoustic facies classes, but still needs user oversight…
  - appropriate parameters
  - QC of results
  - user-designated segmentations if the algorithms do not perform as desired in certain areas

- Needed new geoform descriptors for shoulders, valleys, footslopes. Proposed new provisional geoform units for deep sea seamount features.

- ROV video data annotation, classification into CMECS biotic classes, and community analysis provides valuable groundtruth data and insights into explored areas (value-added insights from the raw video footage)

Acknowledgments

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- Mark Finkbeiner, NOAA Office for Coastal Management
- UNH Center for Coastal and Ocean Mapping / Joint Hydrographic Center
- NOAA Office of Ocean Exploration & Research

OER/*Okeanos Explorer* Website: *https://oceanexplorer.noaa.gov/*

CMECS Web Site: *http://www.iocm.noaa.gov/cmecs*

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