

# *E/V Nautilus* North Pacific Mapping and Exploration – Seamounts, Lava and Mapping the Gaps



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**Mapping and Science Coordinator**  
**Ocean Exploration Trust**



**Map the Gaps**  
**November 14, 2018**

# EXPLORATION vs. TRADITIONAL RESEARCH

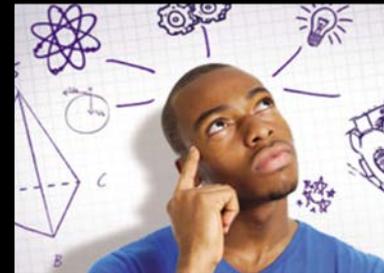
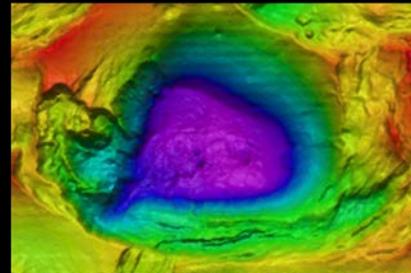
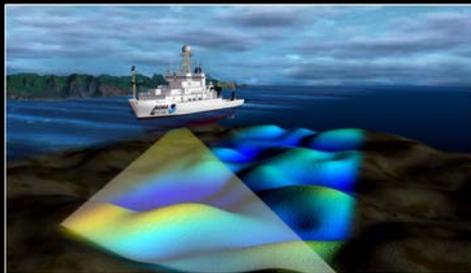
Science - Hypothesis Testing:

HYPOTHESIS → RESEARCH → ANSWERS



Exploration - Hypothesis Generating:

EXPLORATION → DISCOVERY → HYPOTHESIS

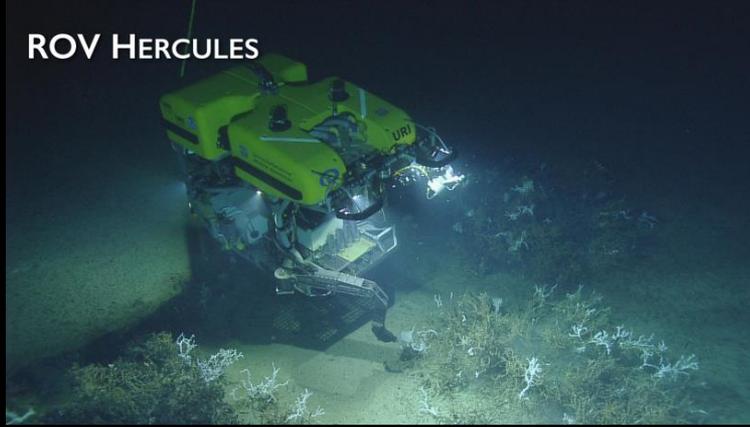




# OPERATIONS & CAPABILITIES

NextGen - April 2013 - Knoxville 50P

ROV HERCULES



ROV ARGUS





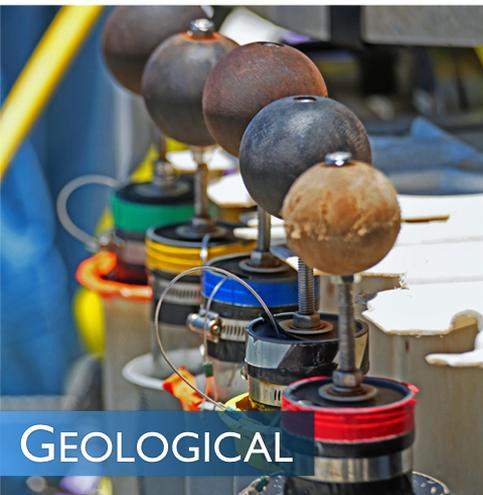
# ROV SAMPLING CAPABILITIES



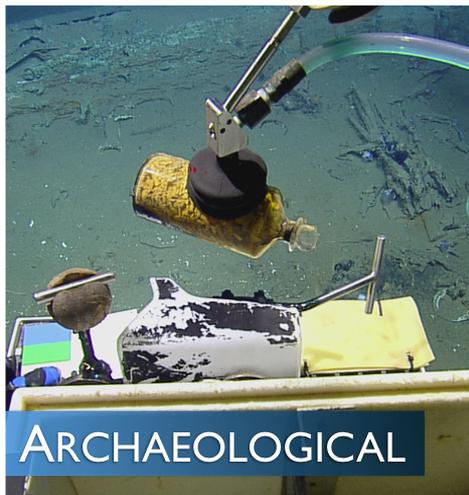
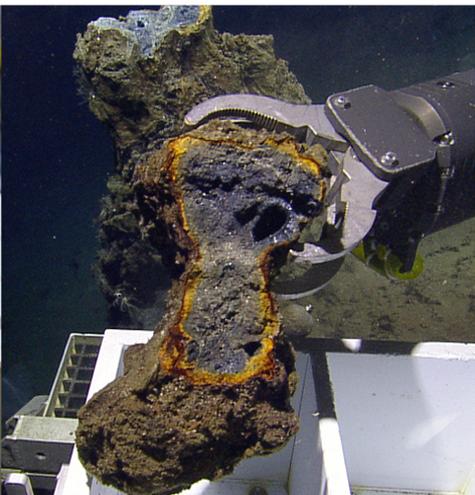
BIOLOGICAL



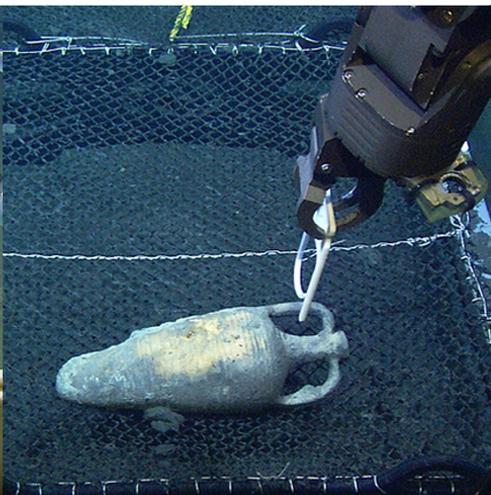
WATER & GAS



GEOLOGICAL



ARCHAEOLOGICAL





# OPERATIONS & CAPABILITIES

Nedraas - April 2013 - Knudsen SSP



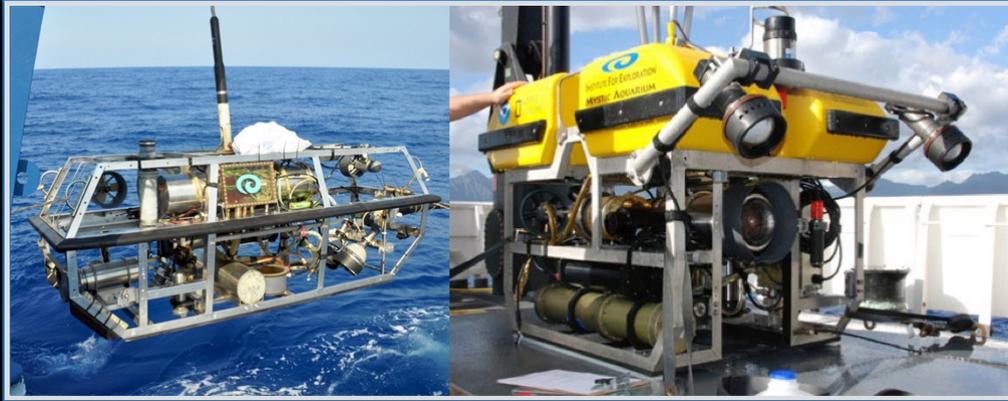
National Geographic Society  
Deepwater Drop-cam





# OPERATIONS & CAPABILITIES

Nedra - April 2013 - Kordax 50P



ROV 6000m Mobile System 2019

ASV hi-resolution mapping





OCEAN NETWORKS CANADA

CASCADIA MARGIN

PACIFIC SEAMOUNTS

MONTEREY BAY

CHANNEL ISLANDS

PAPAHĀNAUMOKUĀKEA  
MARINE NATIONAL MONUMENT

LOIHI SEAMOUNT

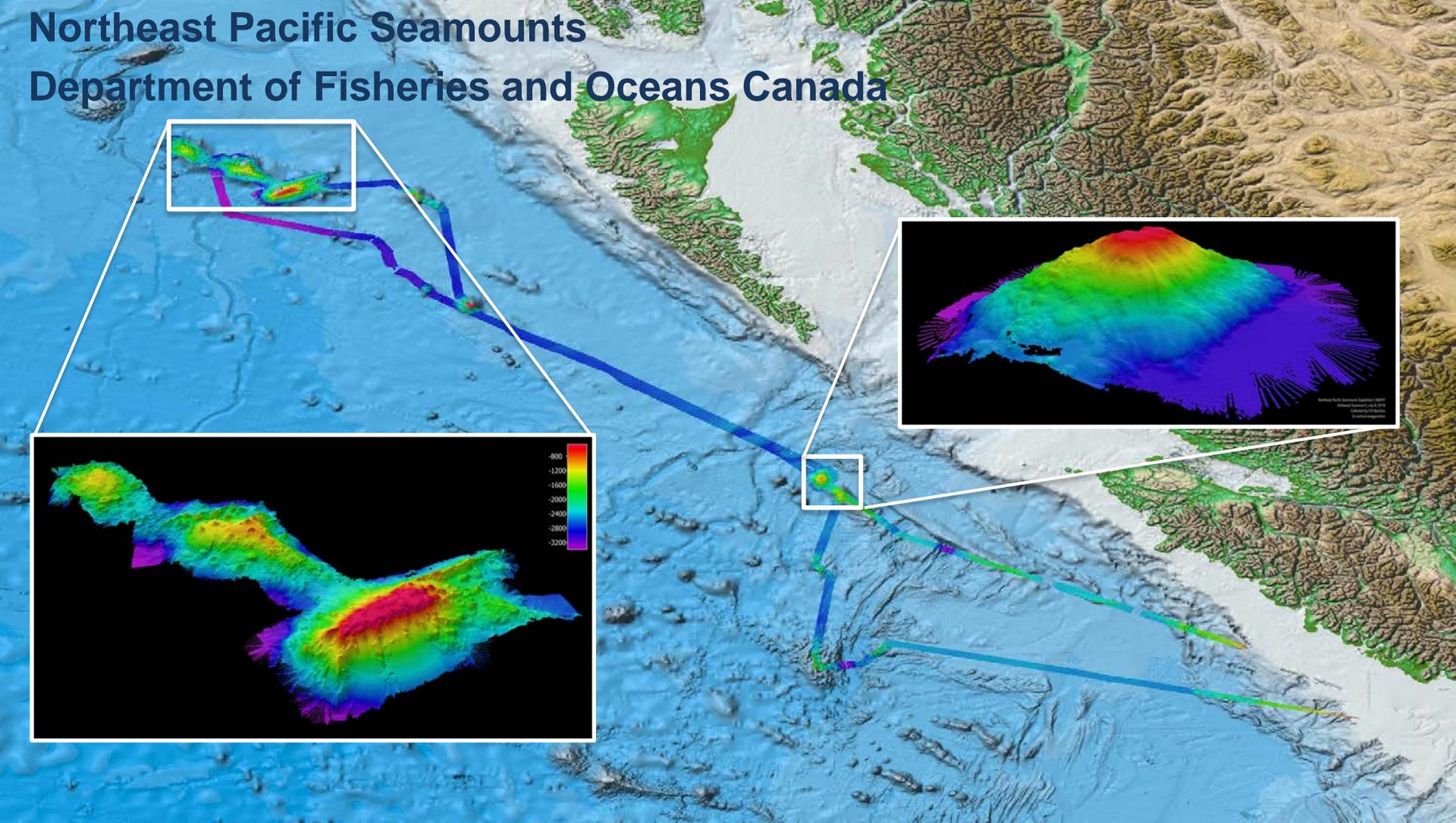
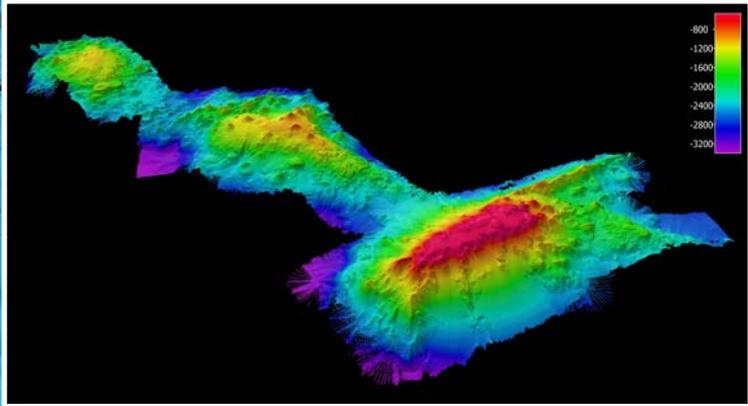
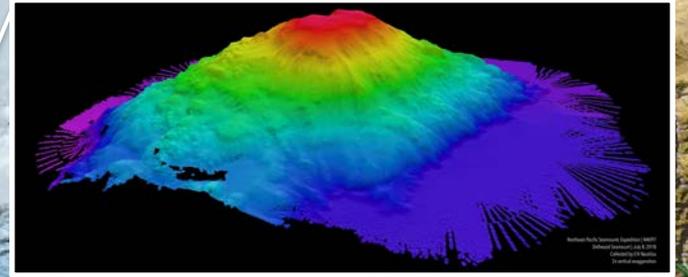
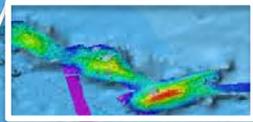
CLARION CLIPPERTON  
FRACTURE ZONE

NAUTILUS LIVE

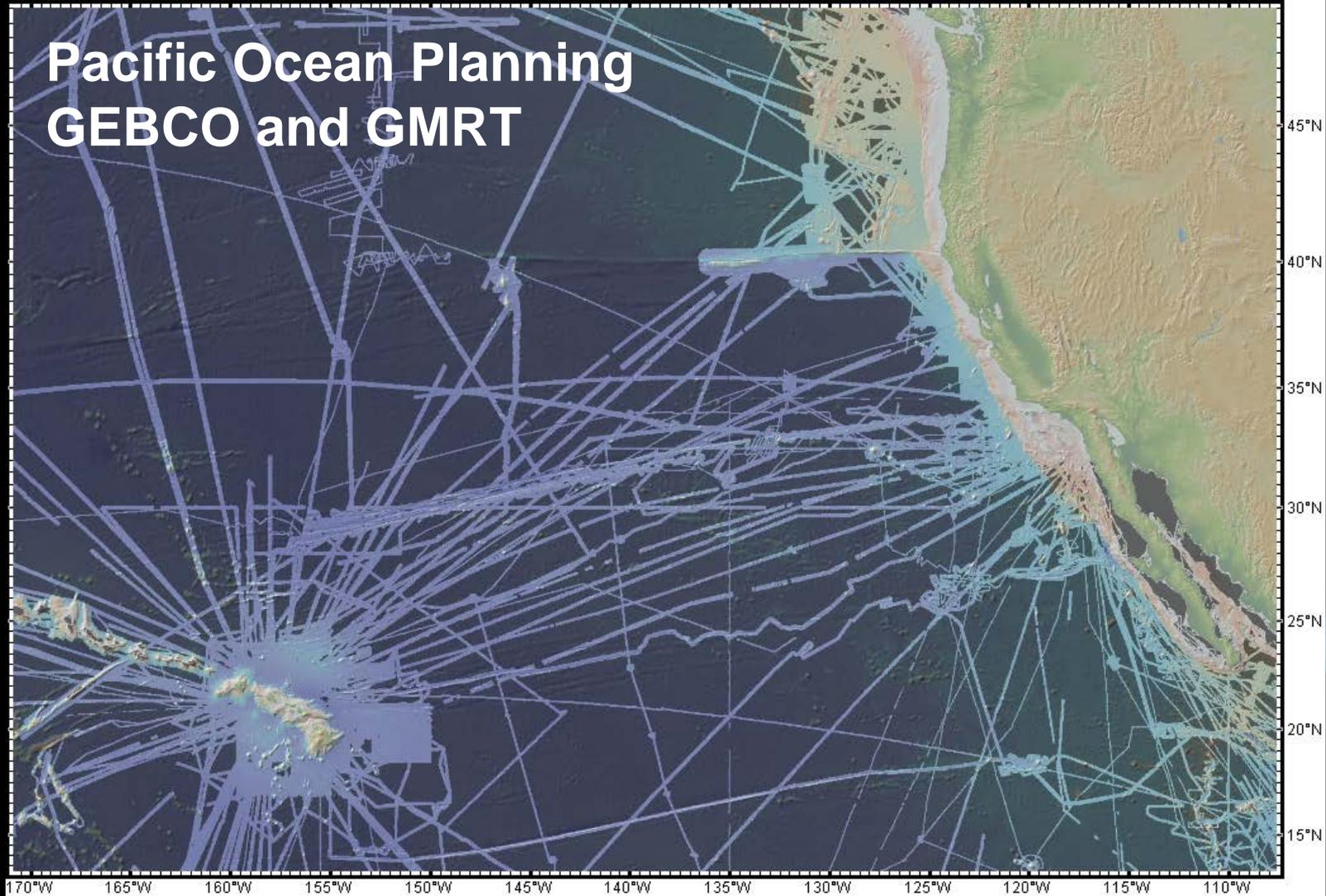
2018

# Northeast Pacific Seamounts

Department of Fisheries and Oceans Canada



# Pacific Ocean Planning GEBCO and GMRT



# Nautilus Transit Mapping

North Pacific Ocean

CV Nautilus

Google Earth

Image Landsat / Copernicus

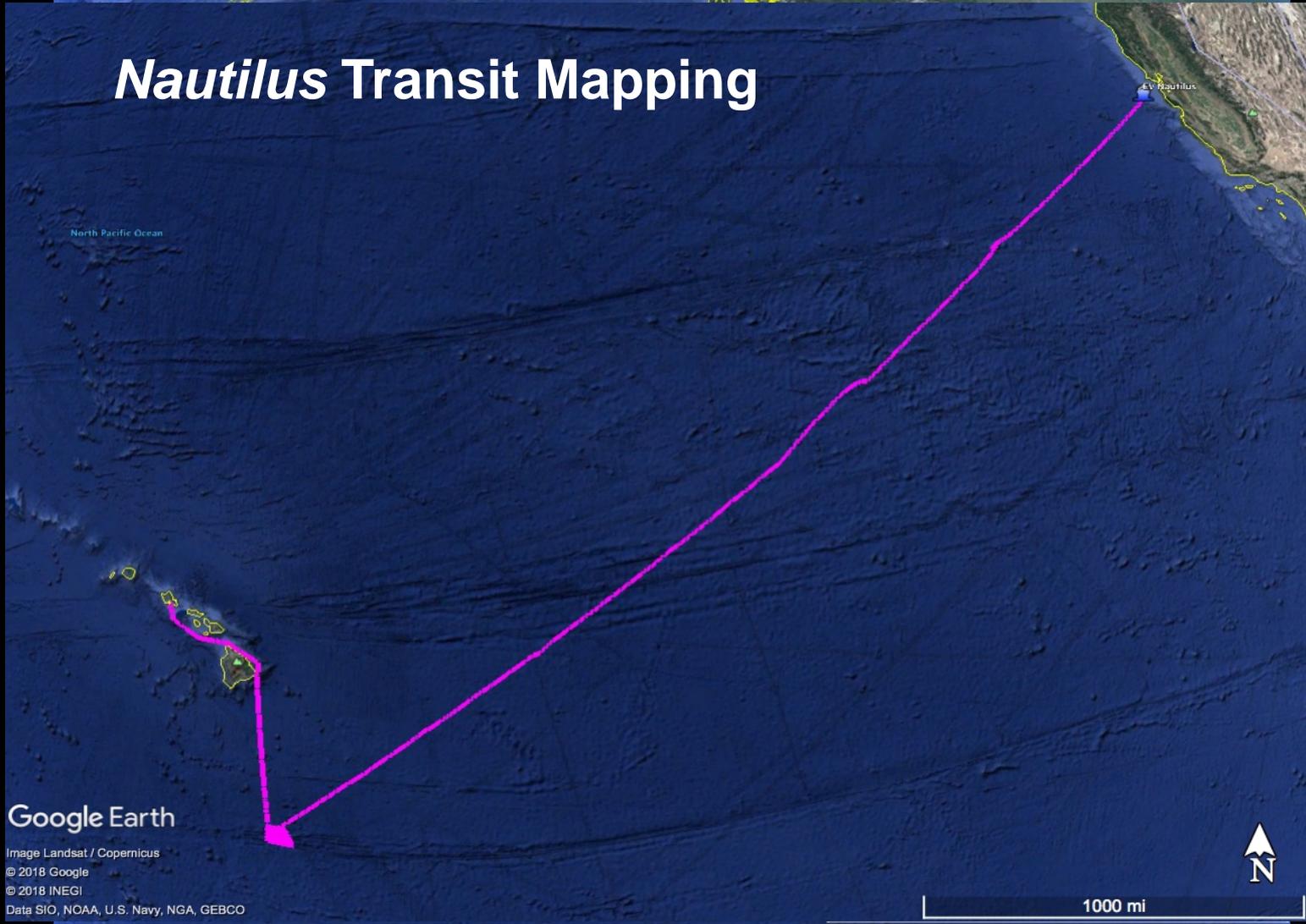
© 2018 Google

© 2018 INEGI

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

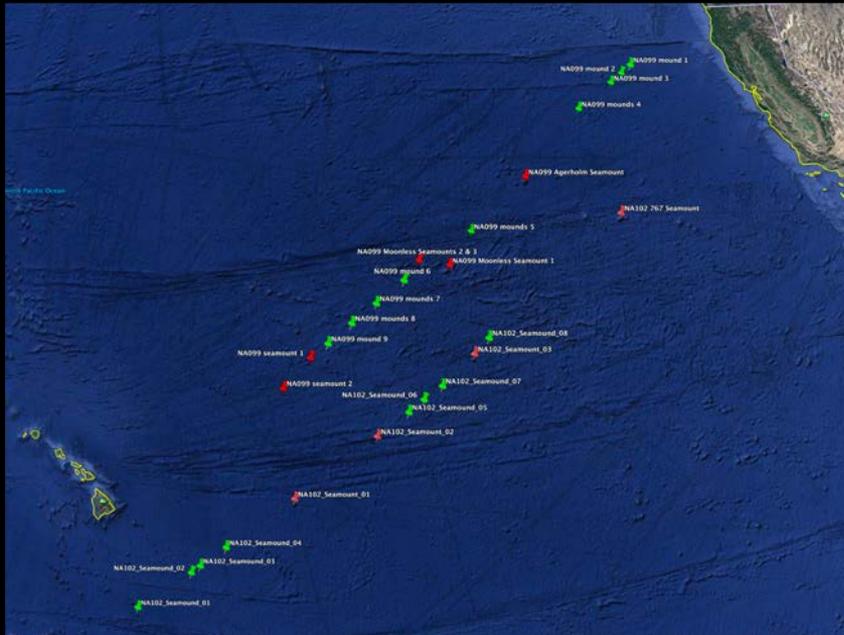


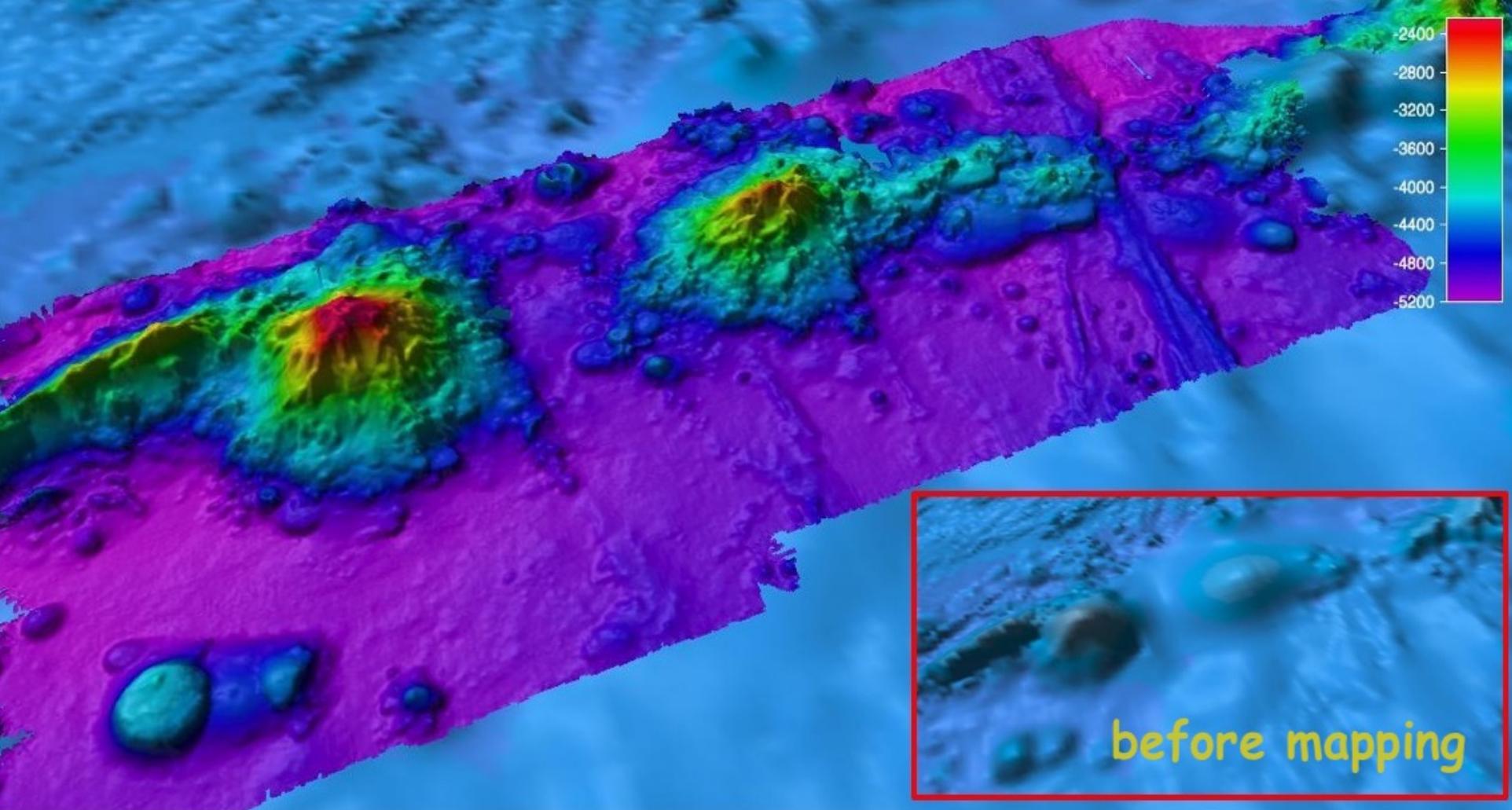
1000 mi



# NA099 and NA 102 – Seamounts and mounds

Differences in depth, position and size between mapped, charted and predicted bathy

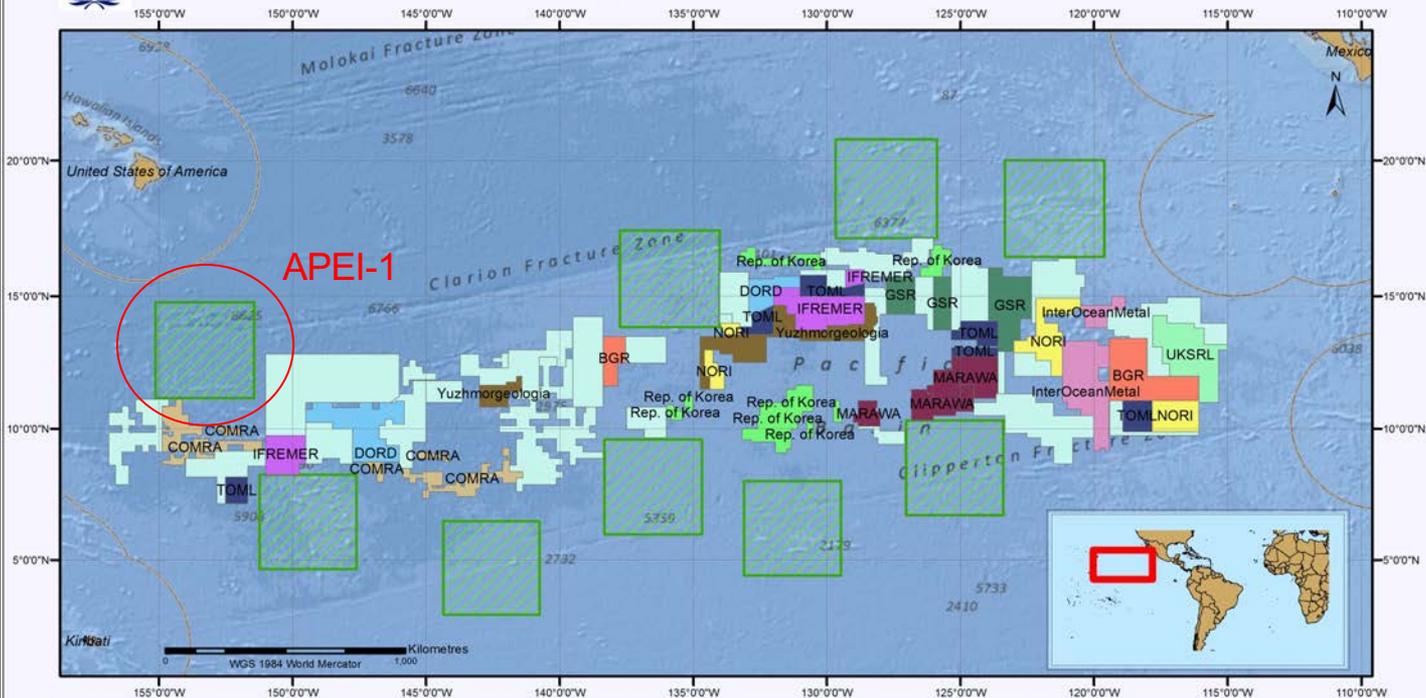






# Polymetallic Nodules Exploration Areas in the Clarion-Clipperton Fracture Zone

Areas under contract and areas reserved for the International Seabed Authority



## Contract area or contract approved as of 28 February 2013

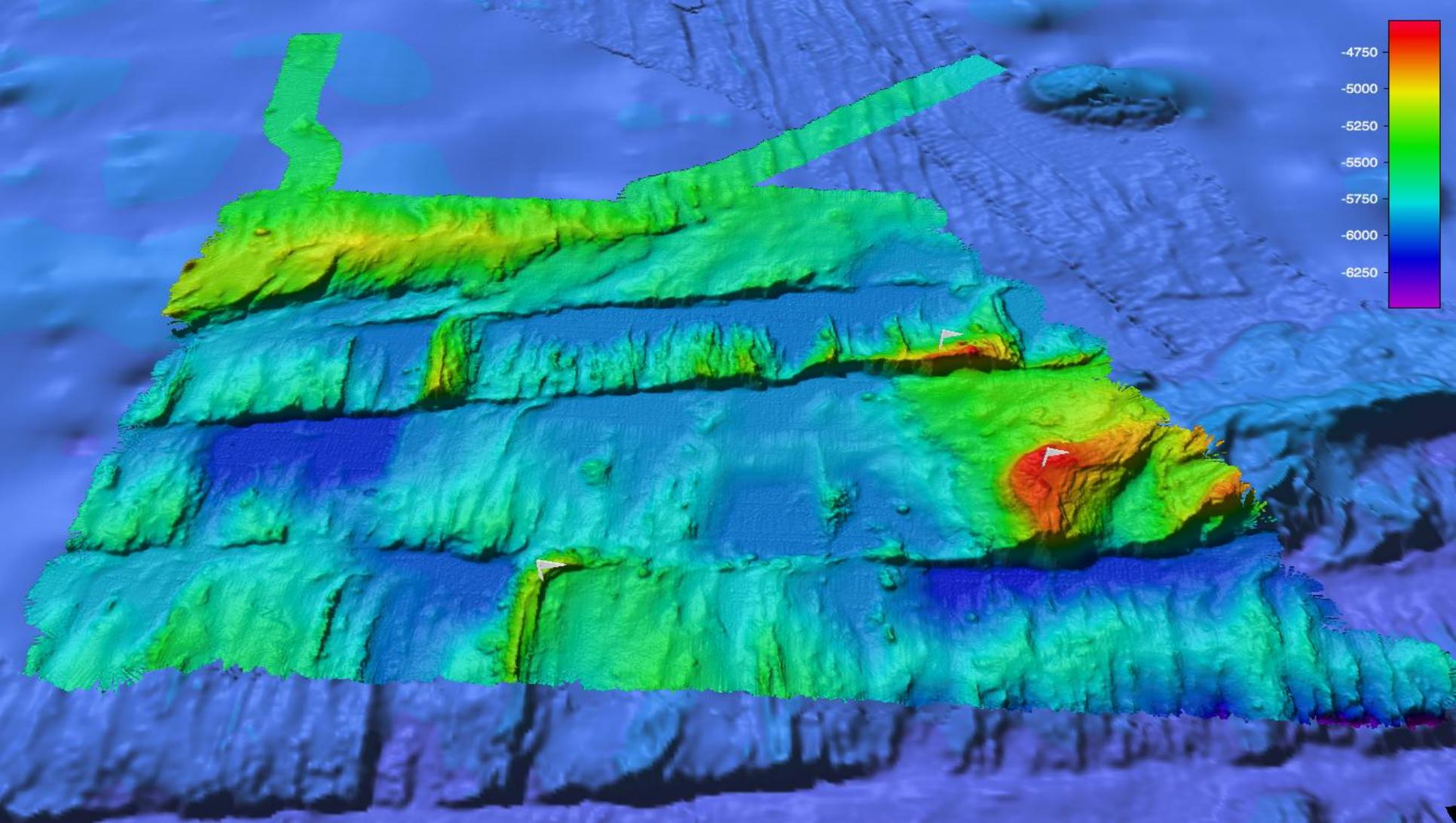
©International Seabed Authority, 2013. Background map: ESRI

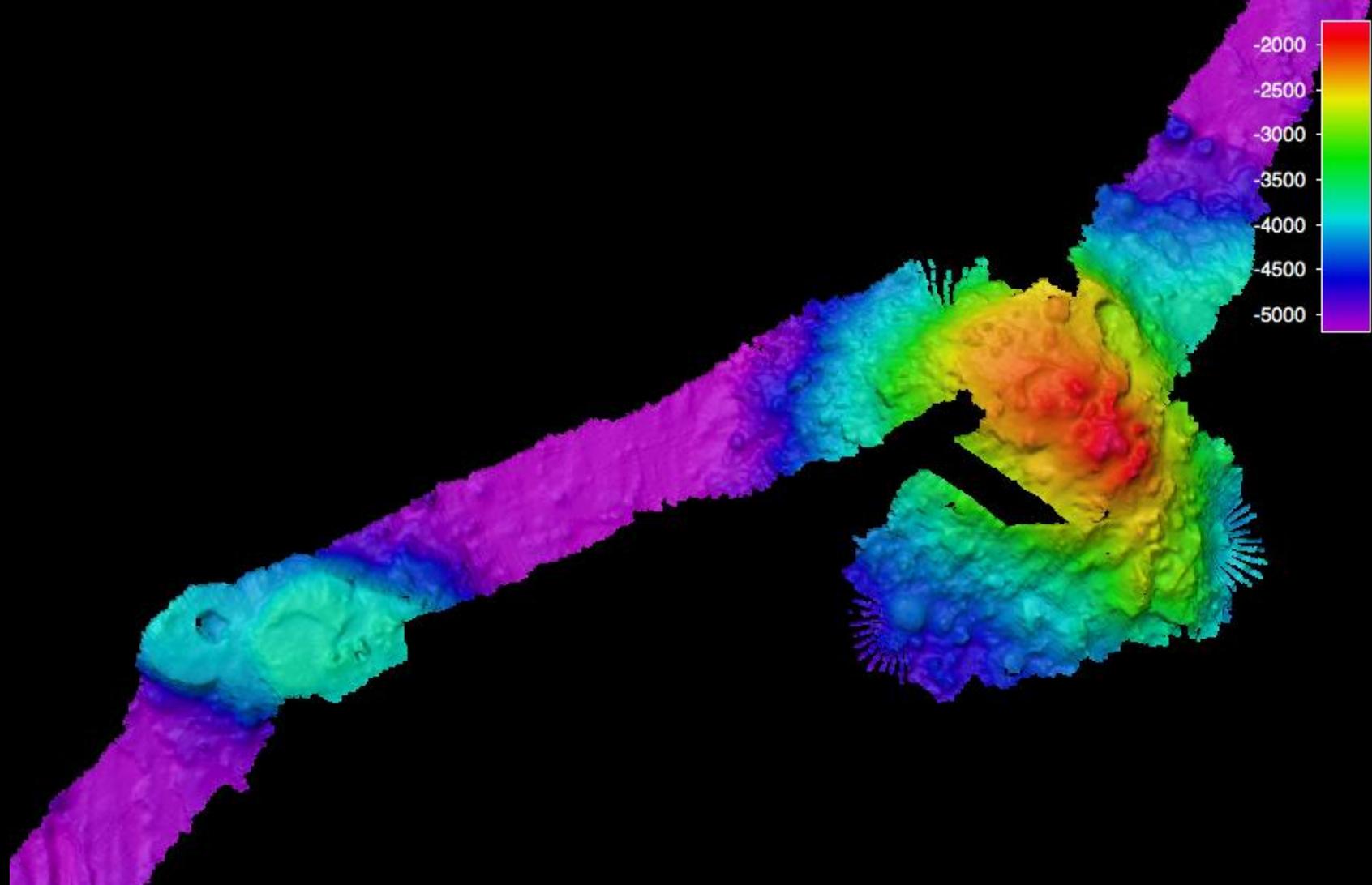
- |   |   |
|---|---|
| Marawa Research and Exploration Ltd (Kiribati)                                    | Institut français de recherche pour l'exploitation de la mer (IFREMER; France)        |
| Bundesanstalt für Geowissenschaften und Rohstoffe (BGR; Germany)                  | Interoceanmetal (IOM; Bulgaria, Cuba, Czech Republic, Poland, Russian Fed., Slovakia) |
| China Ocean Mineral Resources Research and Development Association (COMRA; China) | Nauru Ocean Resources Inc. (NORI; Nauru)  |
| Deep Ocean Resources Development Company (DORD; Japan)                            | Tonga Offshore Mining Ltd (TOML, Tonga)   |
| G-TEC Minerals Resources NV (GSR; Belgium)  | UK Seabed Resources Ltd (UKSRL, UK)   |
| Government of the Republic of Korea   | Yuzhmorgeologia (Russian Federation)  |

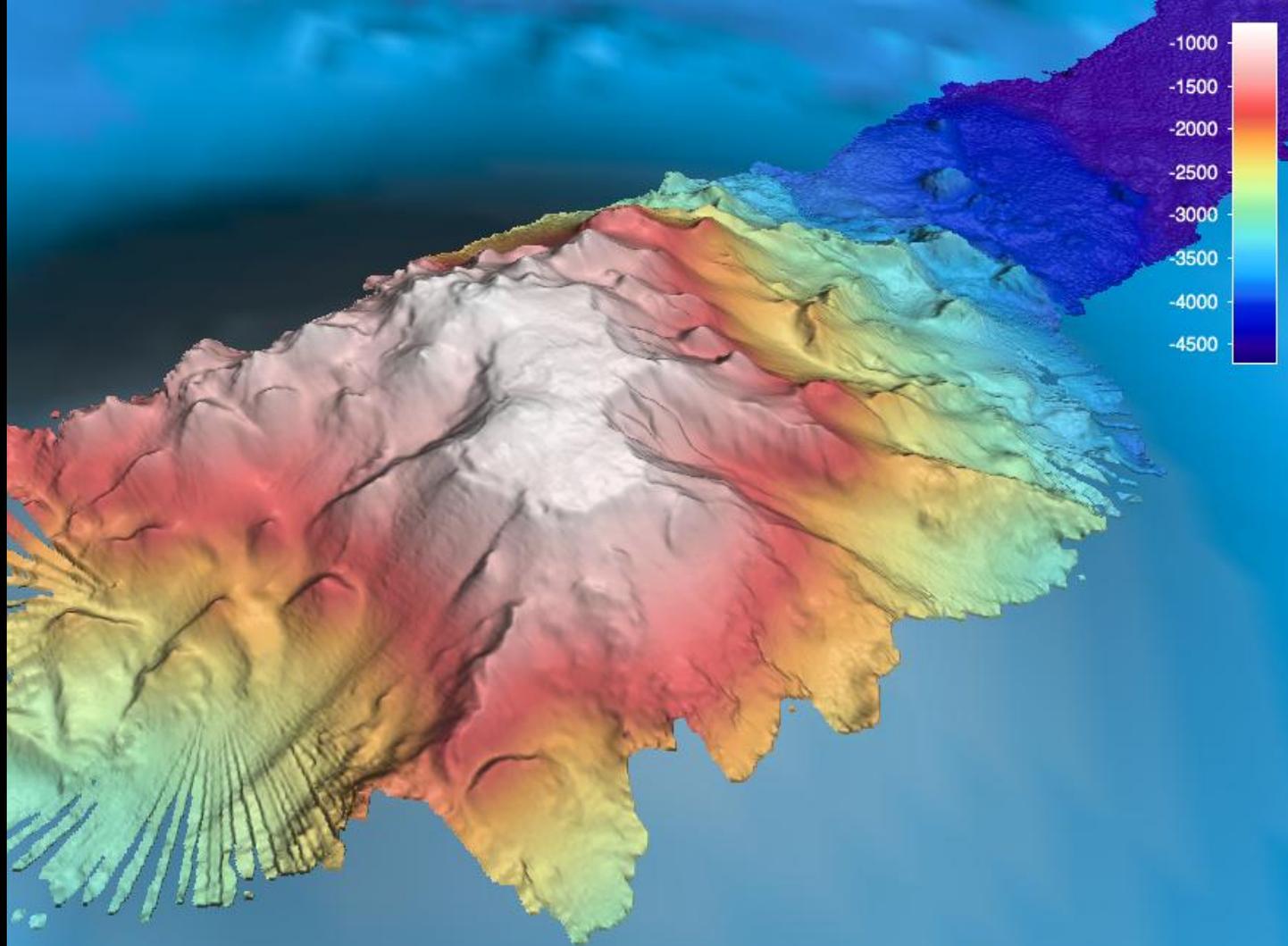
- |                |  |                                       |
|----------------|--|---------------------------------------|
| Reserved area* | Area of particular environmental interest (APEI)** | Exclusive Economic Zones (VLIZ, 2011) |
|----------------|--|---------------------------------------|

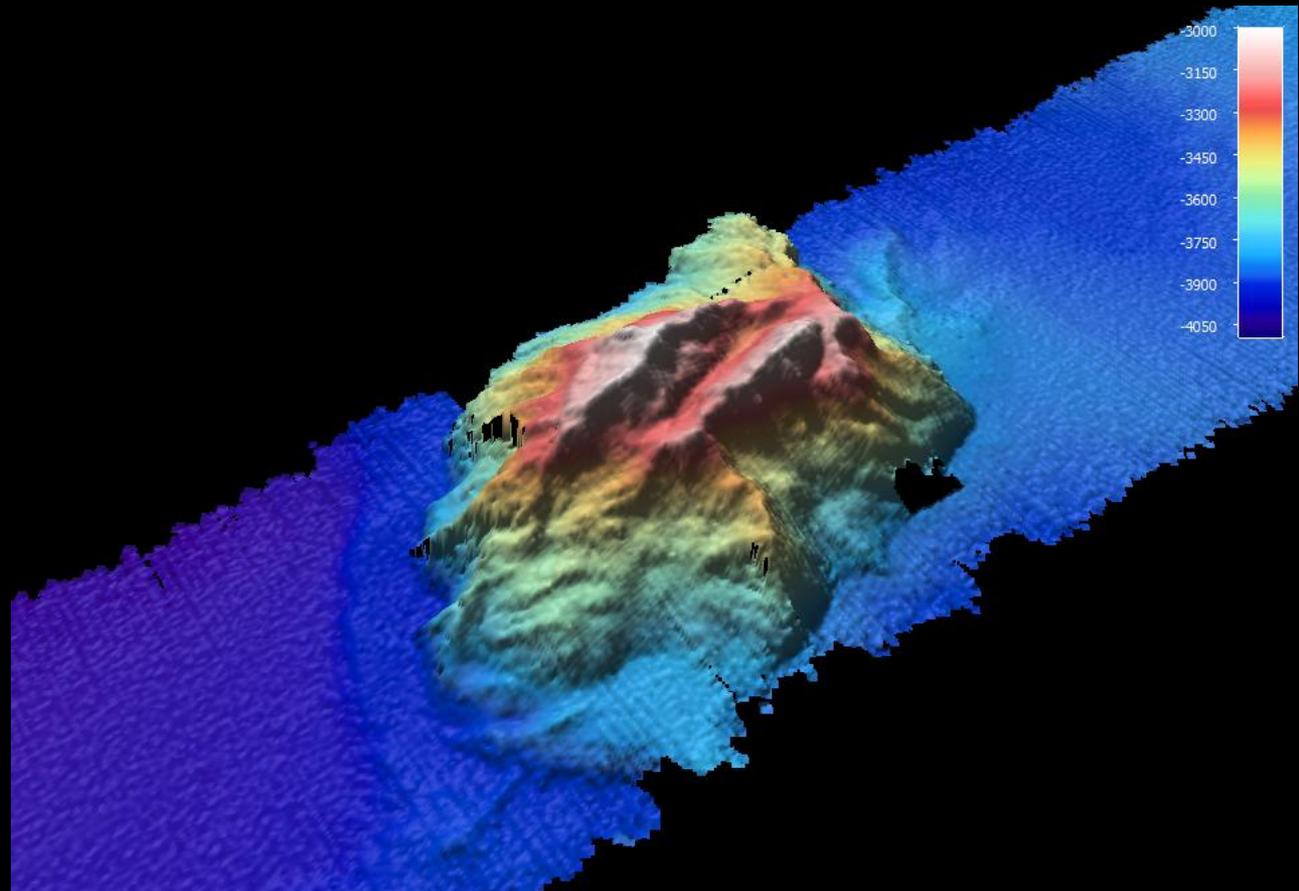
\* In the case of polymetallic nodules, the so-called parallel system provides that each application for exploration by a developed State must cover two parts of "equal estimated commercial value". One part is allocated to the applicant and the other is to become the reserved area, which is set aside for the conduct of activities by the Authority or developing States.

\*\* In July 2012, the Authority adopted an environmental management plan for the Clarion-Clipperton Zone to be implemented on a provisional basis over an initial three-year period. The plan includes the designation of a network of areas of particular environmental interest (ISBA/18/C/22).

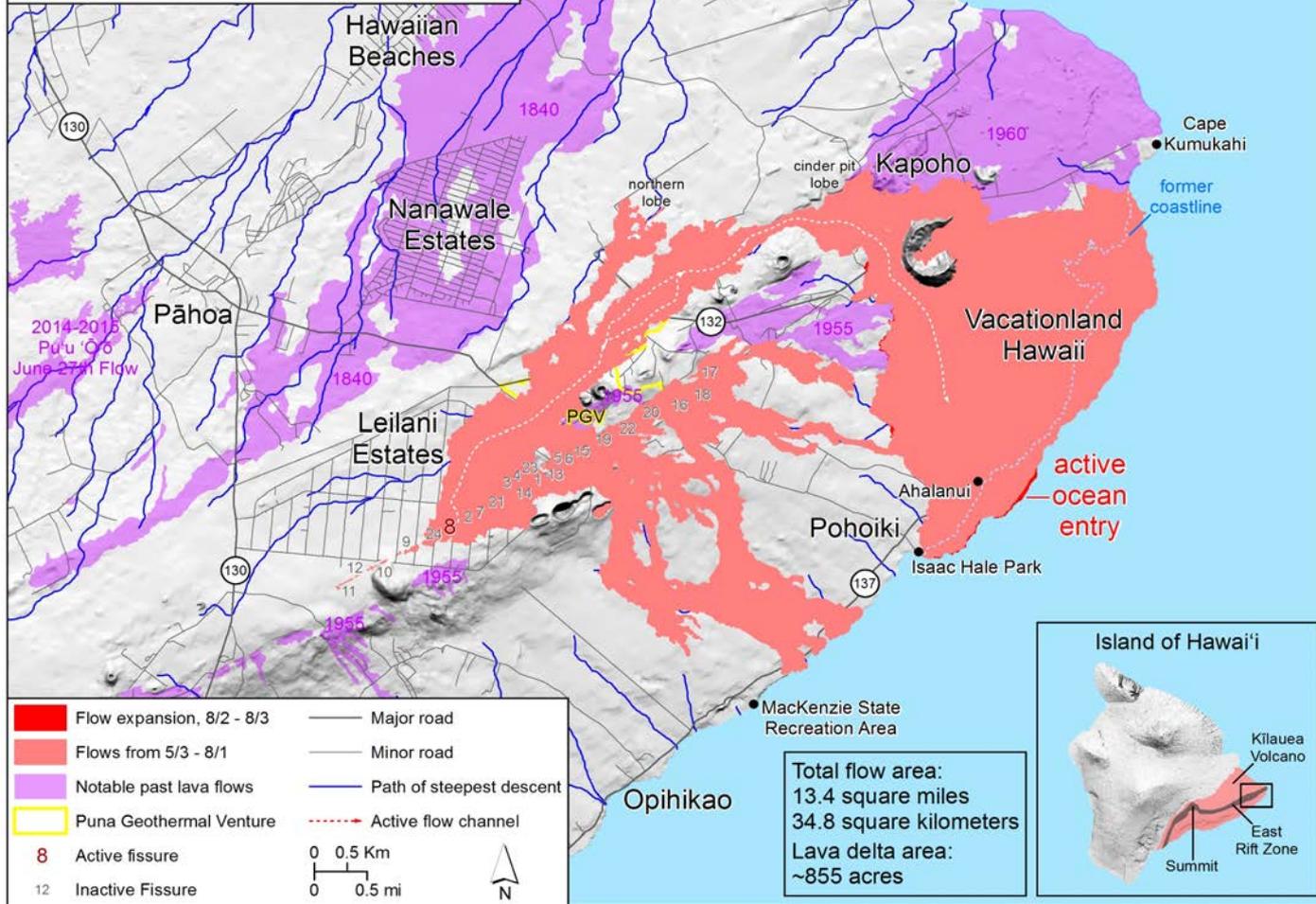






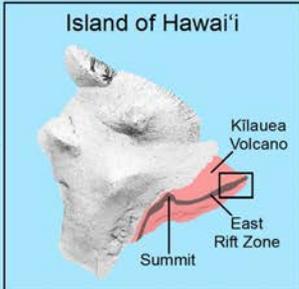


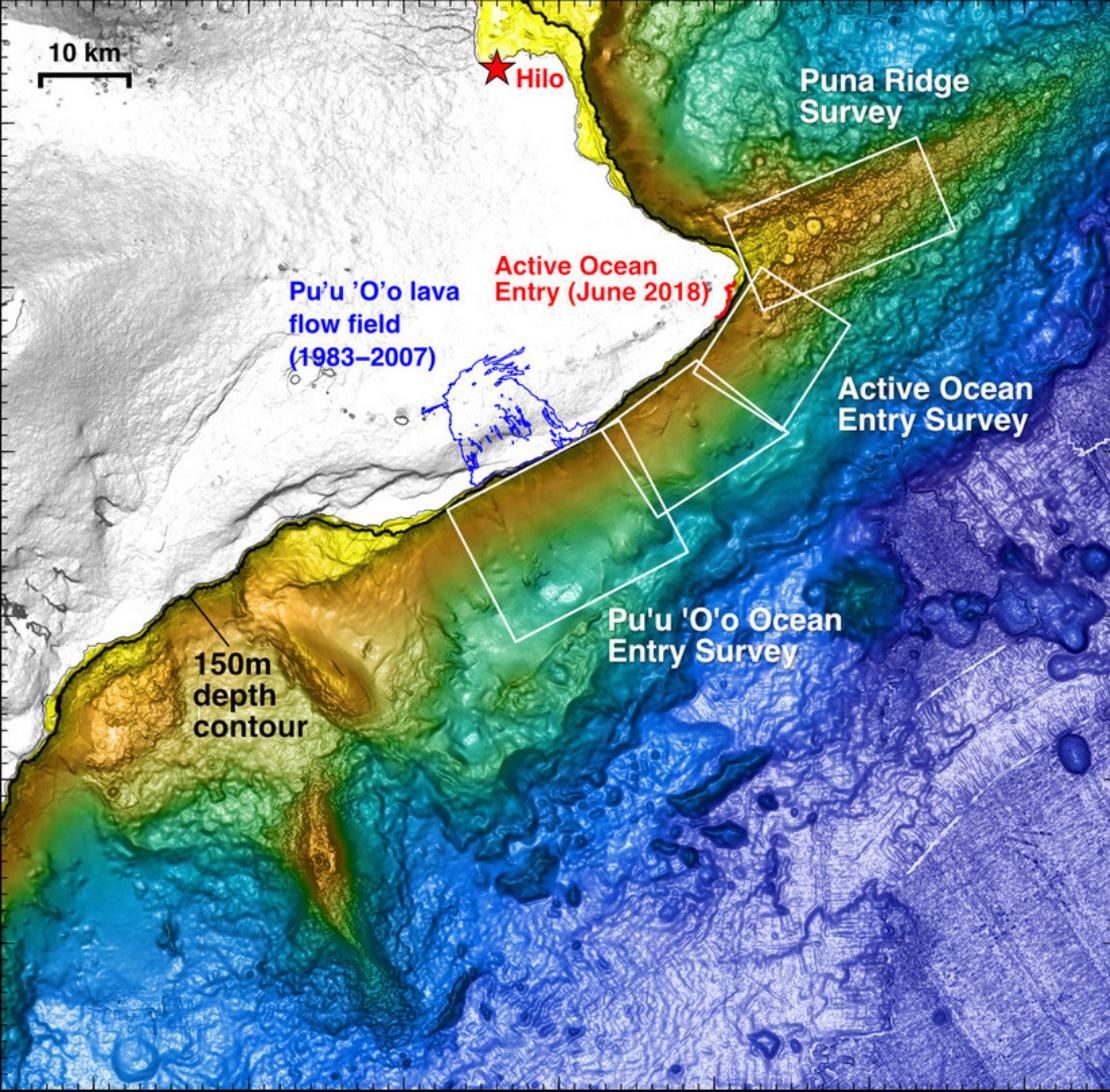
Kīlauea Volcano - East Rift Zone  
 Updated 10:00 am, August 3, 2018



	Flow expansion, 8/2 - 8/3		Major road
	Flows from 5/3 - 8/1		Minor road
	Notable past lava flows		Path of steepest descent
	Puna Geothermal Venture		Active flow channel
	Active fissure		
	Inactive Fissure		

Total flow area:  
 13.4 square miles  
 34.8 square kilometers  
 Lava delta area:  
 ~855 acres



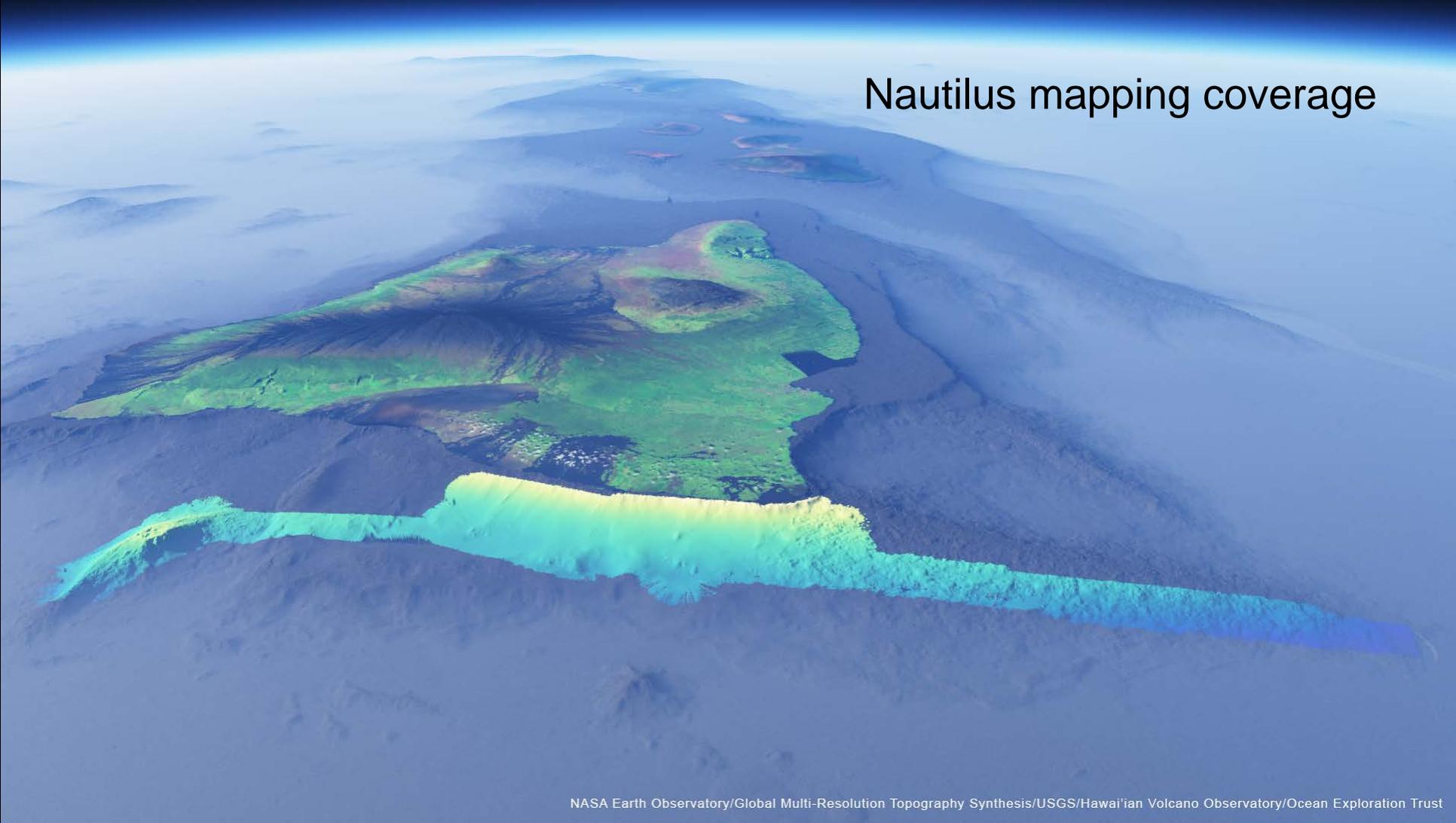


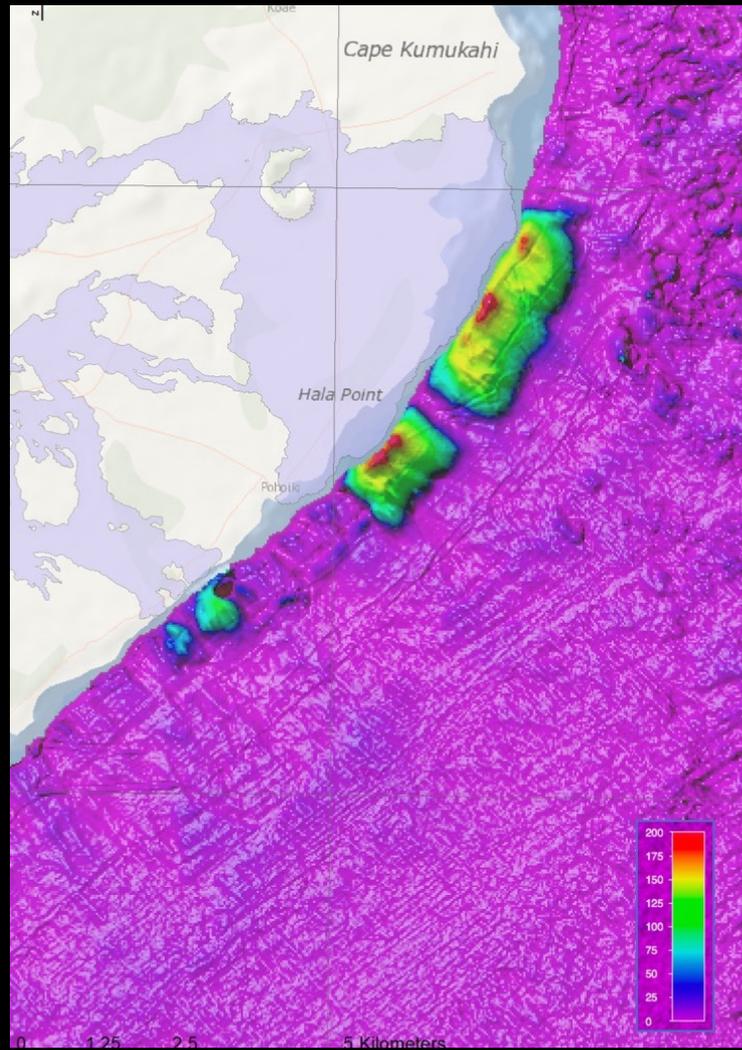
NA099 – Lead scientist  
Larry Mayer (CCOM UNH)

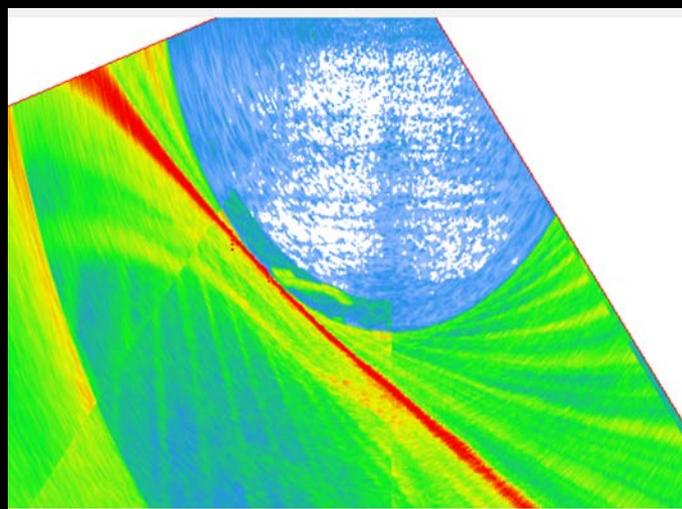
Kilauea mapping -  
Lead scientist ashore  
Adam Soule (WHOI)

NA100 – Co-Leads  
Chris German (WHOI)  
Darlene Lim (NASA)

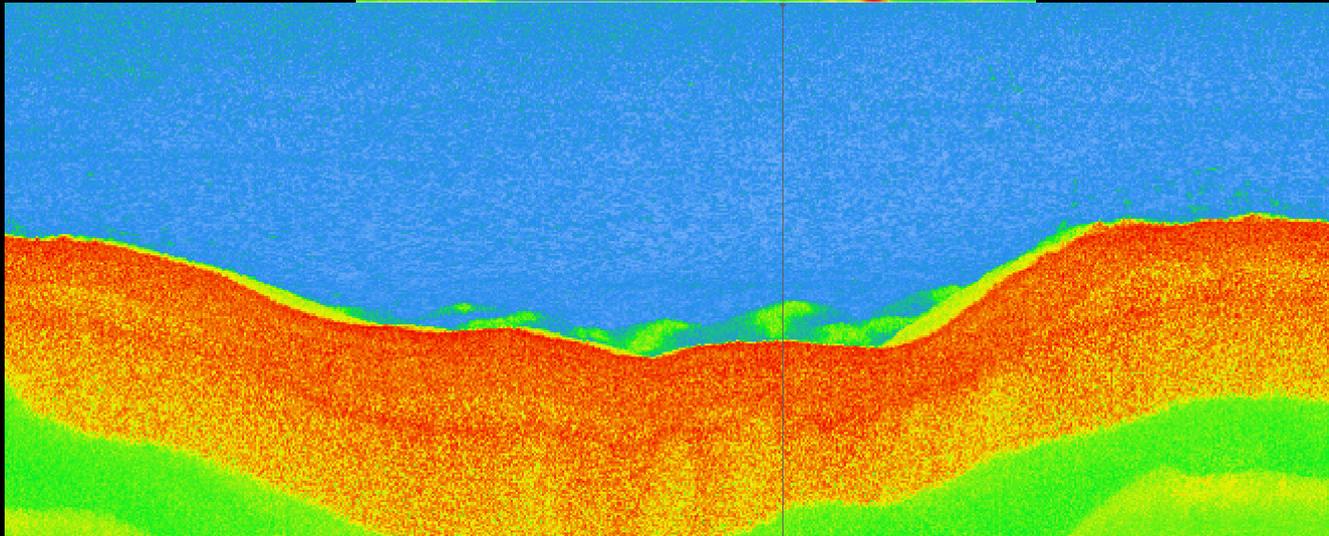
# Nautilus mapping coverage

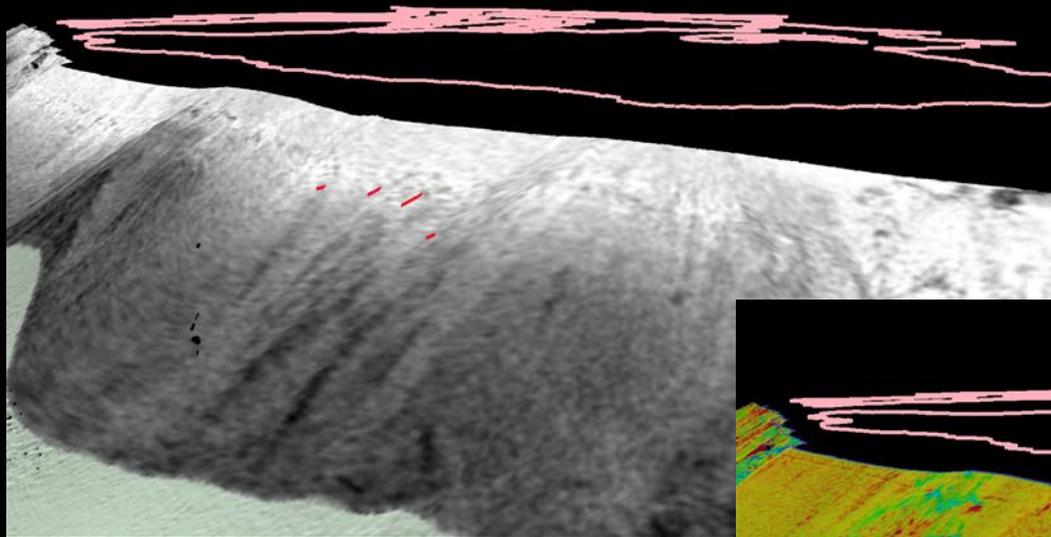




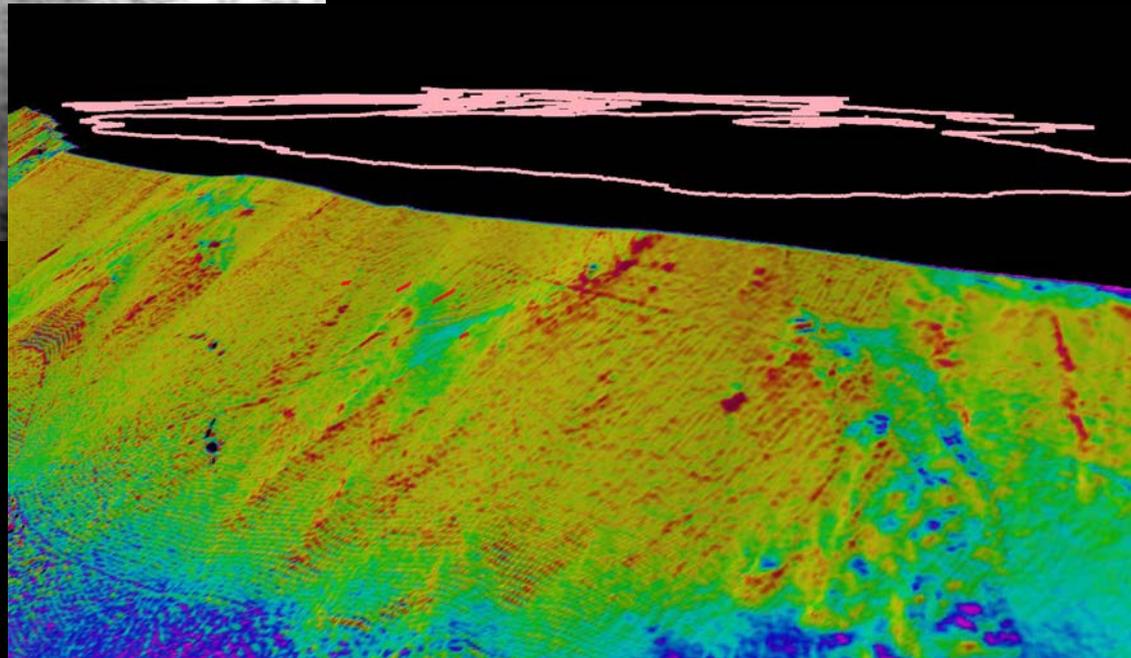


NA099 water column  
contacts

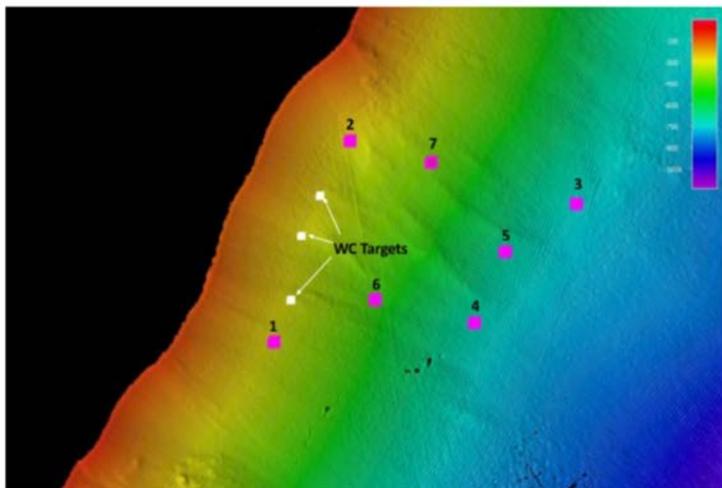




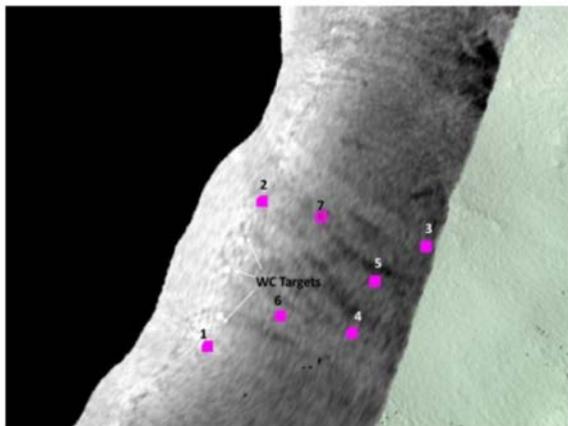
NA099 water column  
contacts



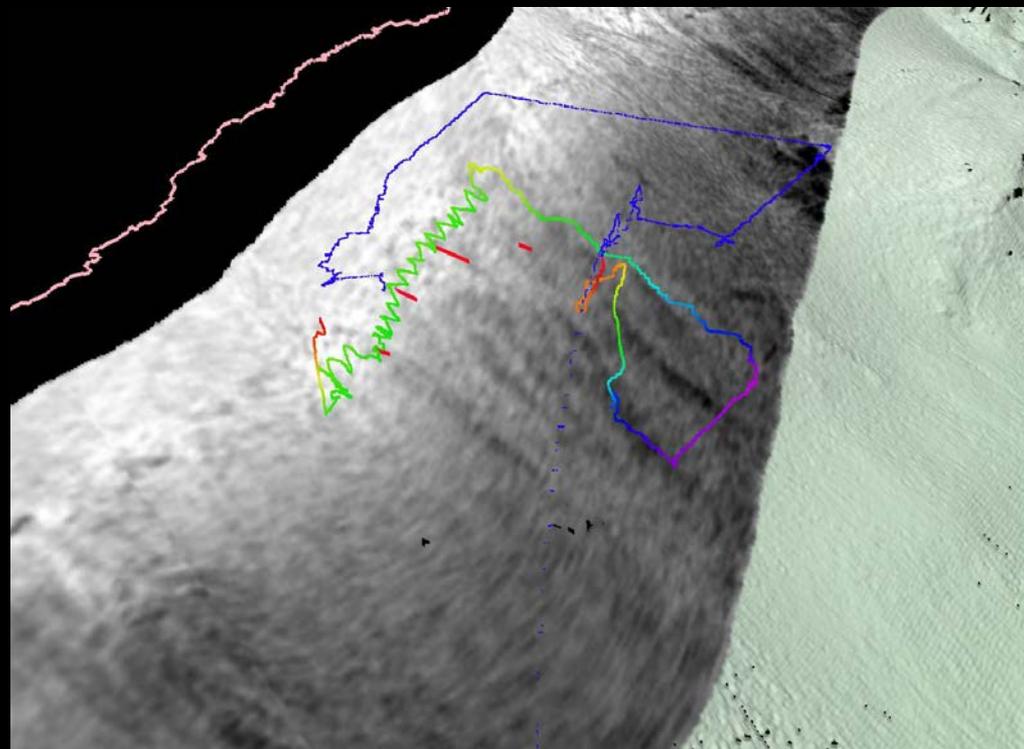
# NA100 ROV Dive H1714

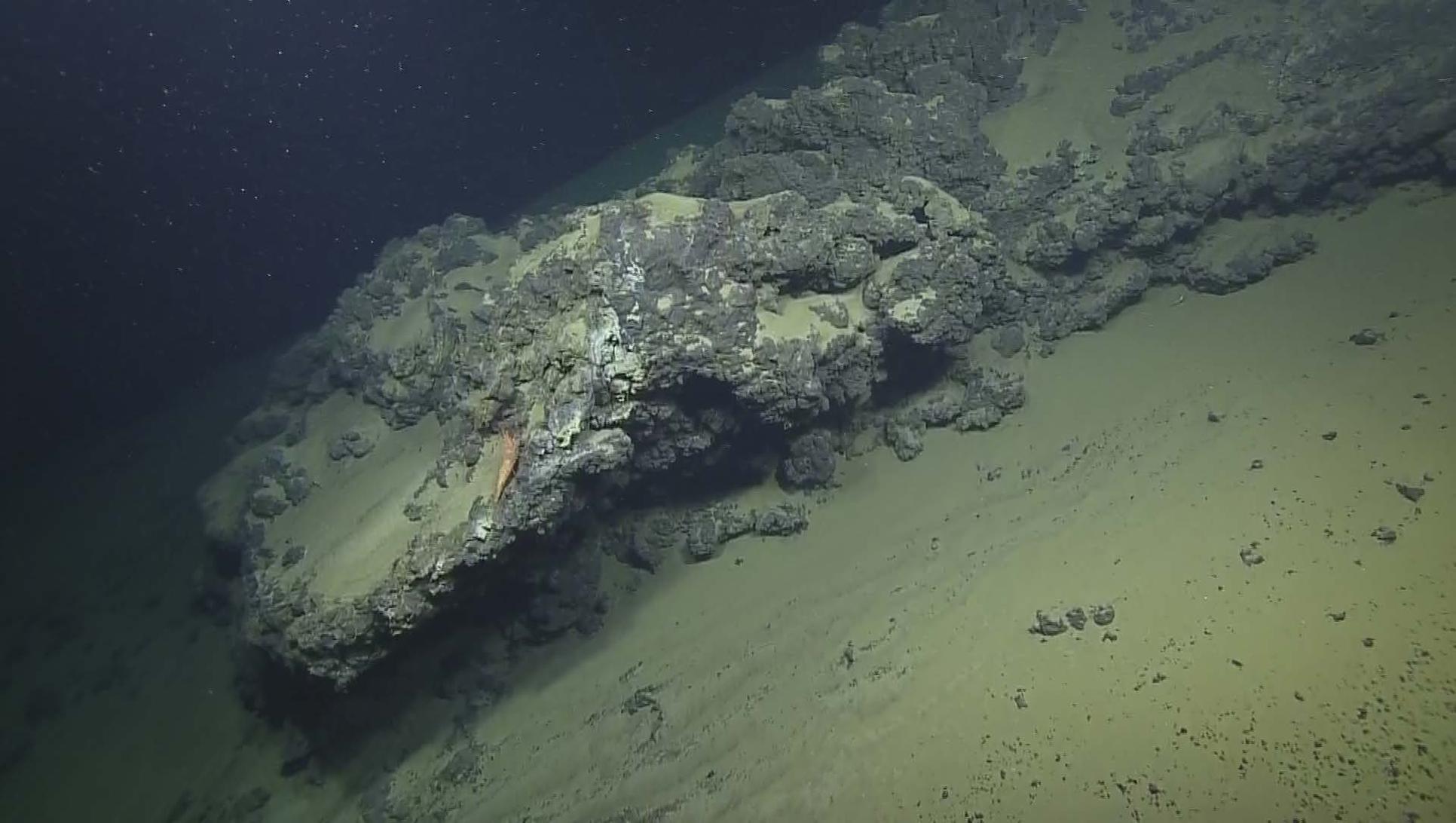


5 m grid bathymetry data with waypoints (magenta) and water column picks (white)



Backscatter data with waypoints (magenta) and water column picks (white)



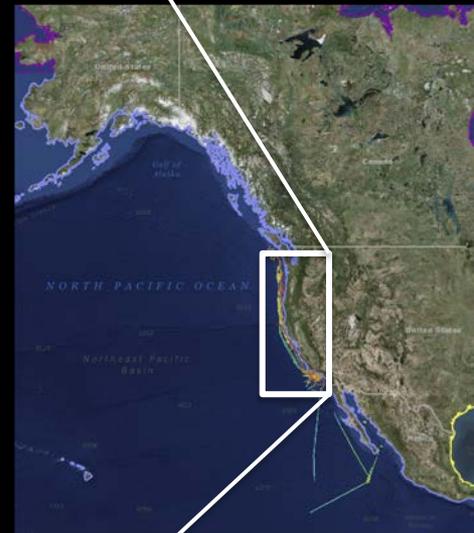


## Mapping Products Per Survey:

- GSFs, geotiff images & floating point, SD file, KML, polygon, survey report, line file report, extinction report, processing log
- Outreach products (handled by production for NL & social media)

## Public Access and archive

- OET archive and access
- 2018 Rolling Deck to Repository to NCEI
- Seabed 2030 North Pacific contribution >100 km<sup>2</sup>



# Mapping - Beginning of Exploration



# Expedition Planning & Data Availability

- Lead scientist represents wider scientific community interests
- Scientists Ashore
  - Sign up online ([www.oceanexplorationtrust.org](http://www.oceanexplorationtrust.org))
  - Planning calls
  - Receive cruise and dive plans and daily ship updates
- Data, video, and samples available to all after cruise
- Annual reports in a supplement published by the Oceanography Society



<https://tos.org/oceanography/issue/volume-31-issue-01-supplement>



Scientists Ashore: join in the discussion & provide AOIs for mapping

Ship Charters: Use *Nautilus* for your exploration project

[www.oceanexplorationtrust.org](http://www.oceanexplorationtrust.org)

Watch at: [www.nautiluslive.org](http://www.nautiluslive.org)

