

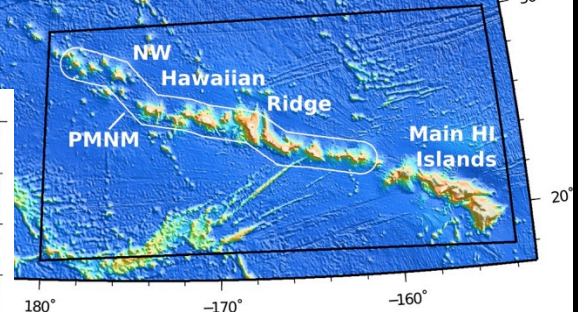
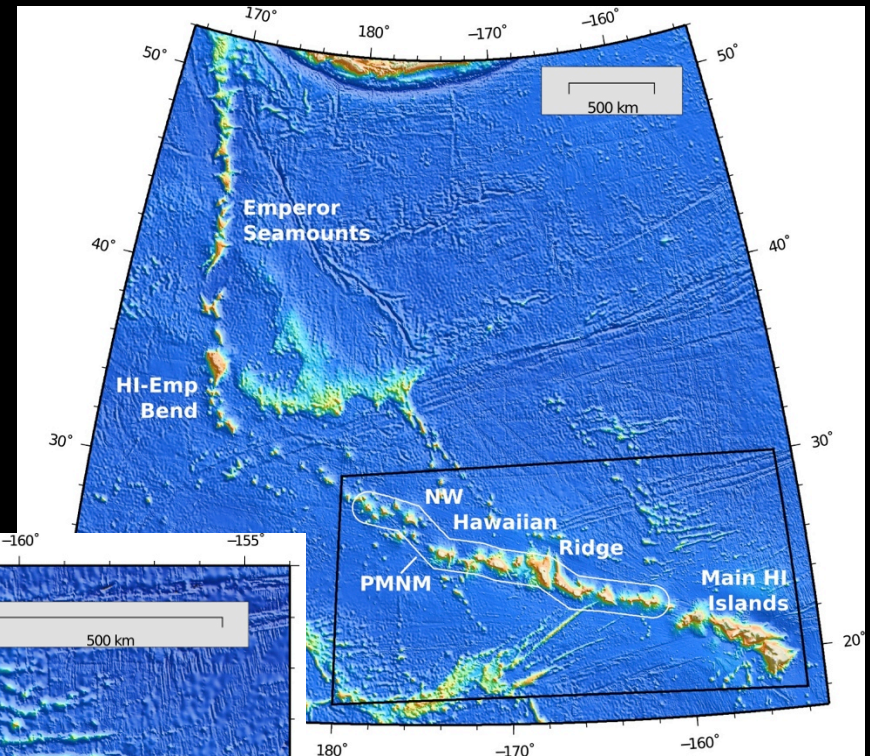
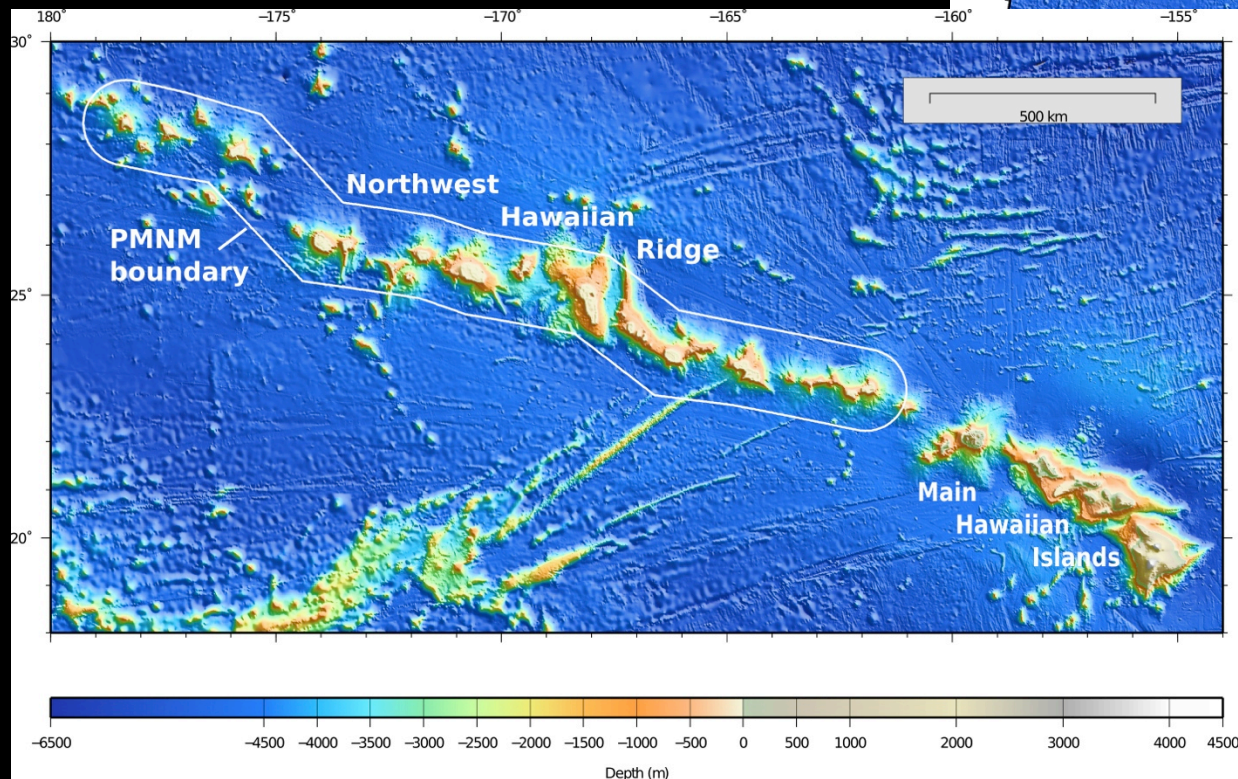
New R/V *Falkor* Multibeam Data from the Papahānaumokuākea Marine National Monument in the Northwestern Hawaiian Islands

J.R. Smith, C. Kelley, B. Boston, B. Dechnik, S. Habel, L. Harrison, J. Leonard, F. Lichowski, D. Luers, J. Miller, R. Orange, M. Patterson, B. Shiro, J. Taylor, H. Togia, J. Tree, J. Tucker, D. Wagner, J. Webster, N. Wright

University of Hawaii/SOEST, University of Sydney, University of British Columbia, and various NOAA groups in Hawaii



Where is it?



What is the Papahānaumokuākea Marine National Monument?



PAPAHĀNAUMOKUĀKEA

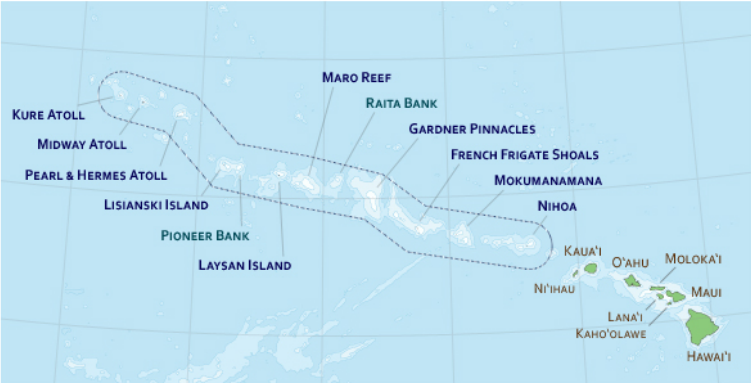
Marine National Monument

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VIRTUAL VISIT

Dozens of tiny islands, atolls and shoals, spanning 1,200 nautical miles of the world's largest ocean, are slowly, quietly slipping into the sea, destined to become seamounts. Hundreds of miles north of Kaua'i, places like Nihoa, Laysan, Pearl and Hermes and Kure comprise the little known, rarely visited Northwestern Hawaiian Islands (NWHI).

Click on the island names below for a virtual visit!



- [Nihoa](#)
- [Mokumanamana](#)
- [French Frigate Shoals](#)
- [Banks and Seamounts](#)
- [Gardner Pinnacles](#)
- [Maro Reef](#)
- [Laysan Island](#)
- [Lisianski Island](#)
- [Pearl and Hermes Atoll](#)
- [Midway Atoll](#)
- [Kure Atoll](#)

If they were laid atop the continental United States, the NWHI would cover a distance equal to that between New York City and Omaha, or Boston and the Florida Everglades.

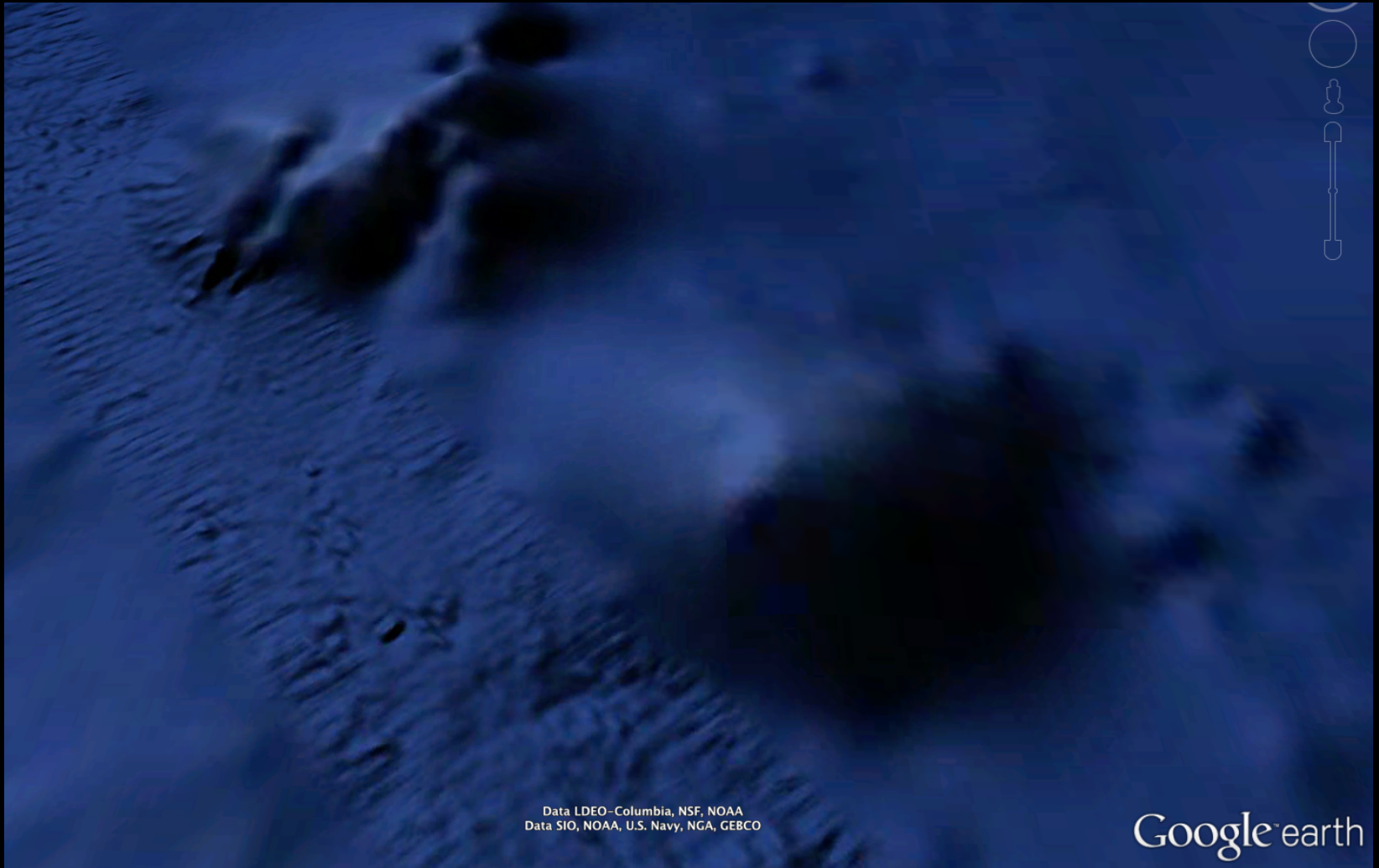
These ancient volcanic remnants with their fringes of truly wild coral reefs remind us of our past—when coral reefs and sea life across the planet thrived—a time before humans became top predator in the ocean food chain.



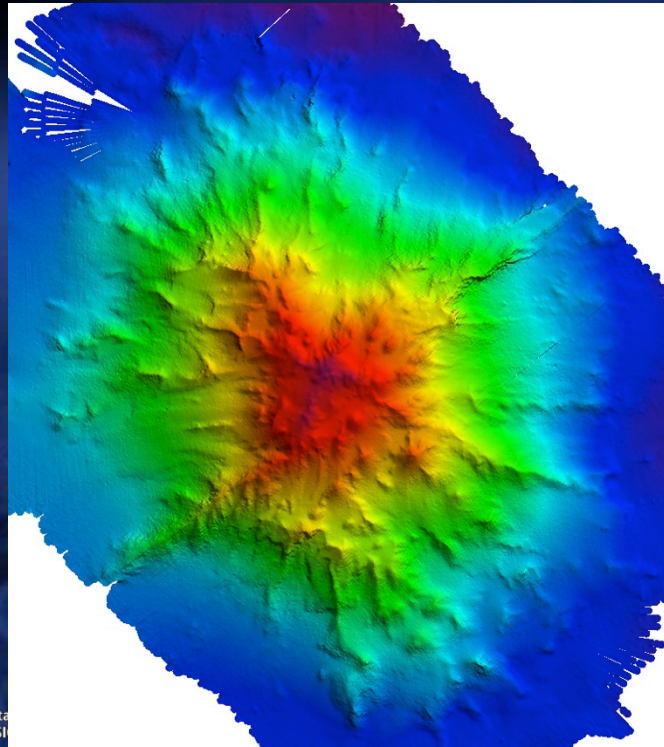
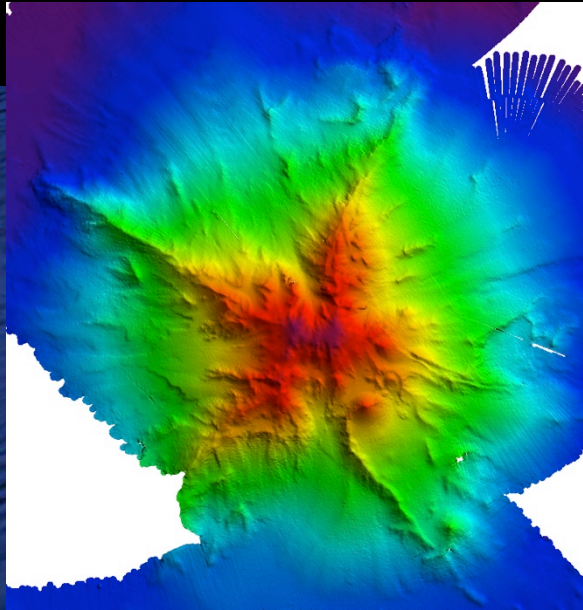
The living coral reef colonies of the NWHI are a spectacular underwater landscape covering thousands of square miles. These reefs are some of the healthiest and least disturbed coral reefs remaining and comprise possibly the last large-scale, predator-dominated coral reef ecosystem on the planet. Over millennia, invertebrate animals and algae have constructed massive structures in the shallow seas. Coral animals, bonded to basalt from



Why map it?



That's why.



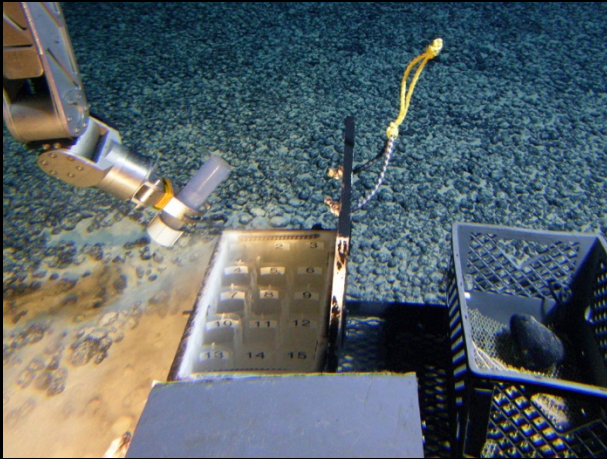
Data
Data S1

Google earth

Why Care About the Deeper Areas of the Monument?

Two Basic Types of Manganese (Mn) Encrustations

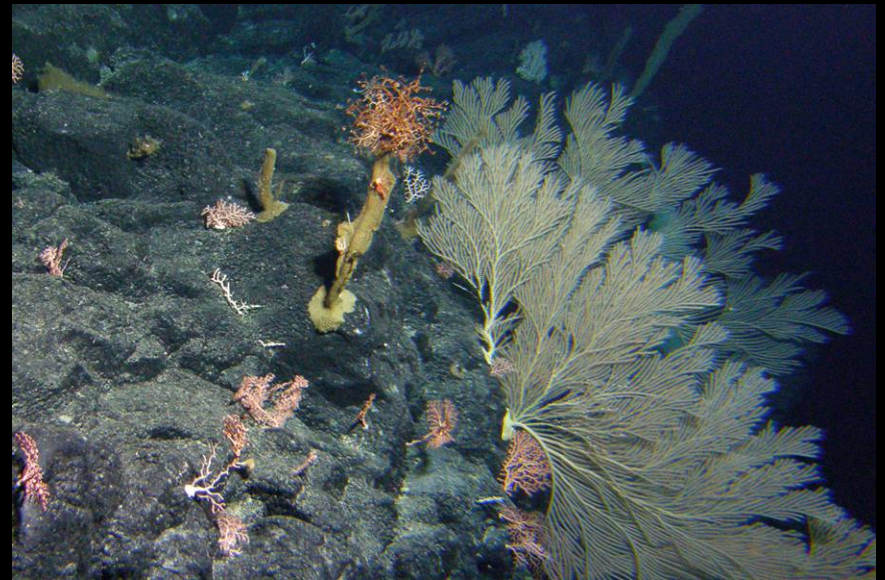
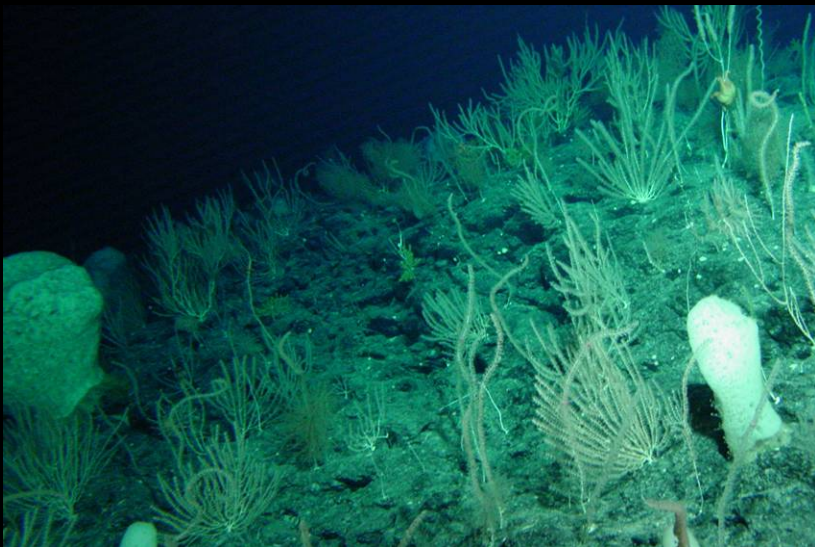
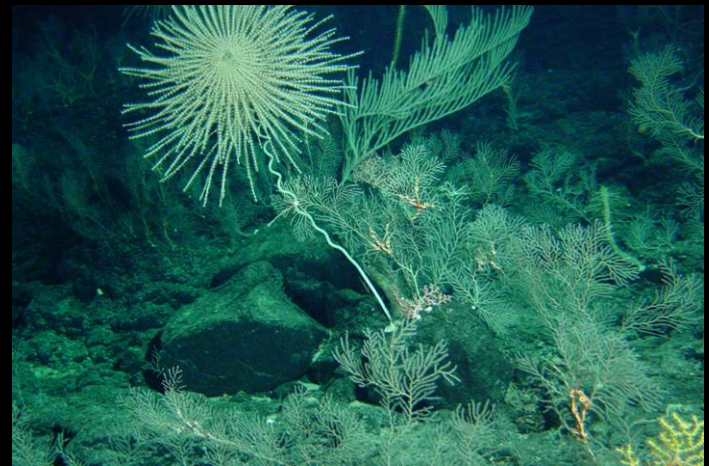
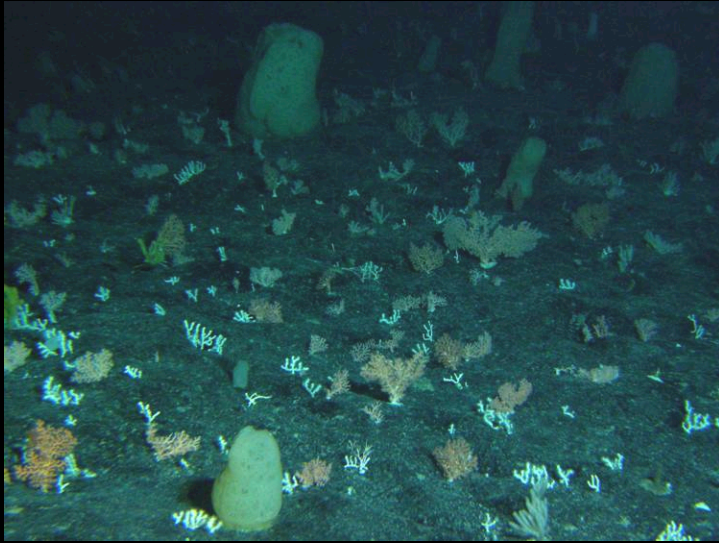
1) Mn nodules: coated pebbles or shell fragments



2) Mn crusts: coated bedrock



High density coral and sponge communities are found at 1000- 2500 m on Mn Crusts

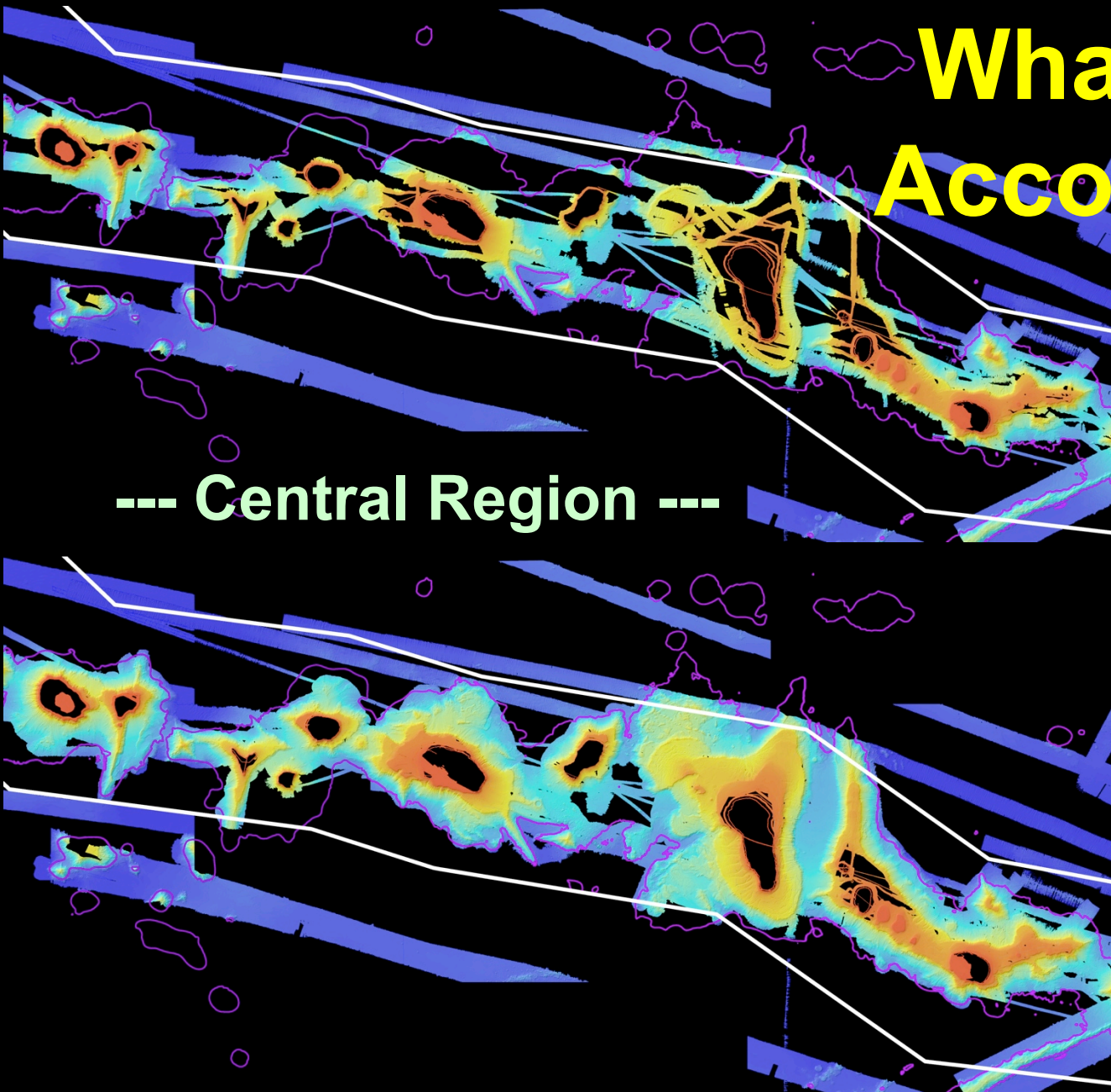


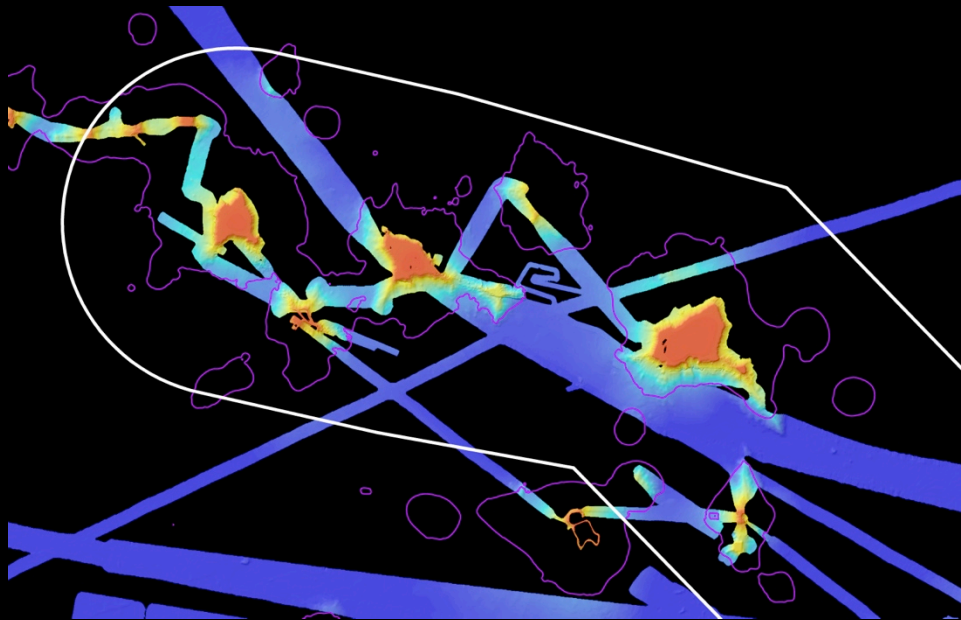
What did we Accomplish?

—Before—

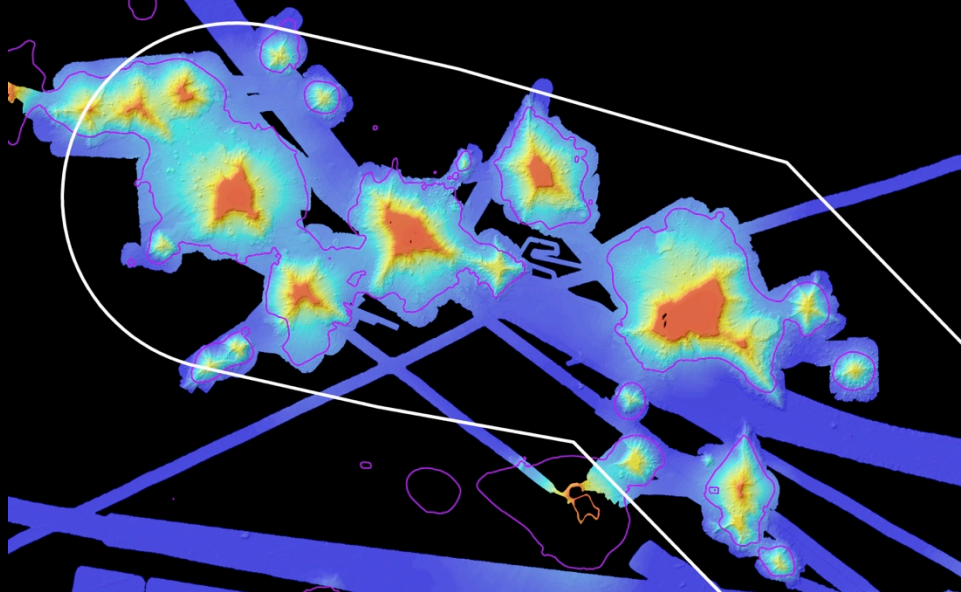
--- Central Region ---

—After—





- Upper Seamount Region -



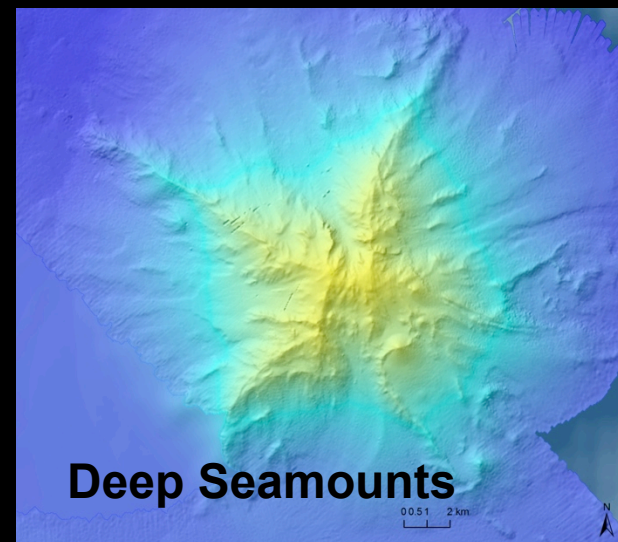
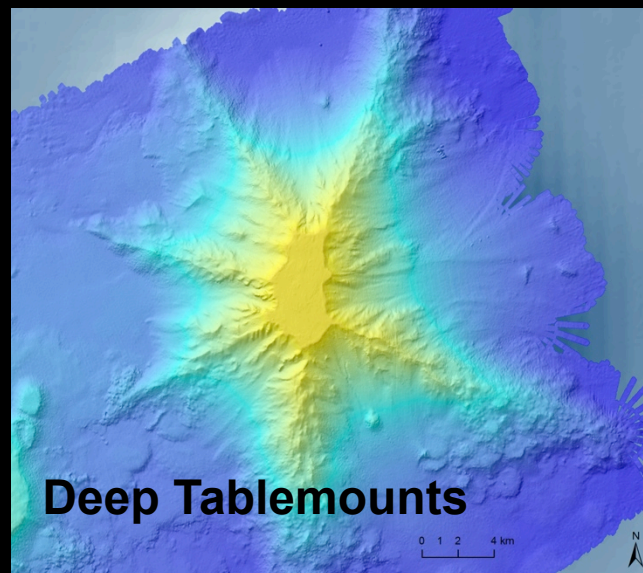
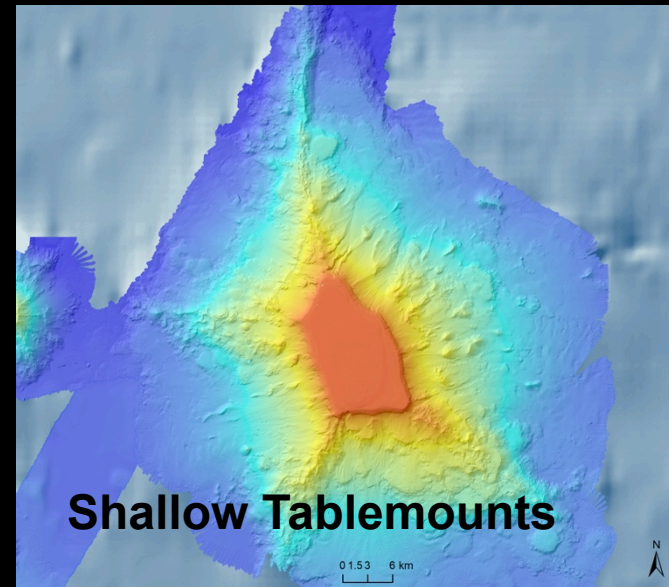
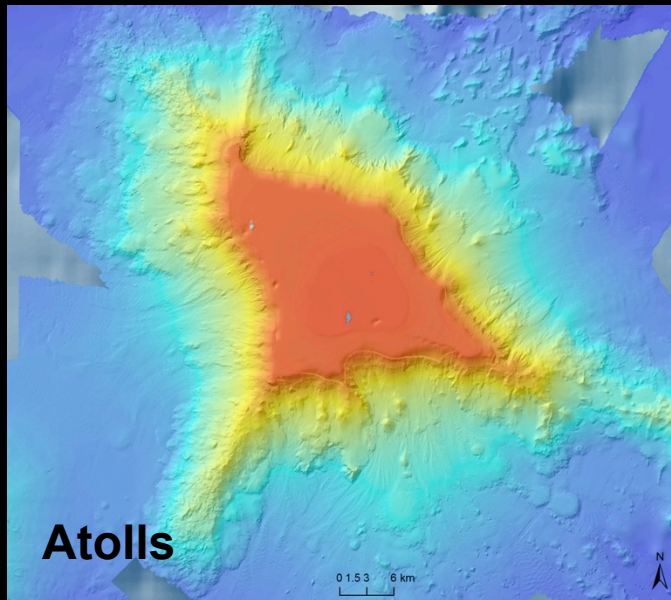
-Before-

Final Stats

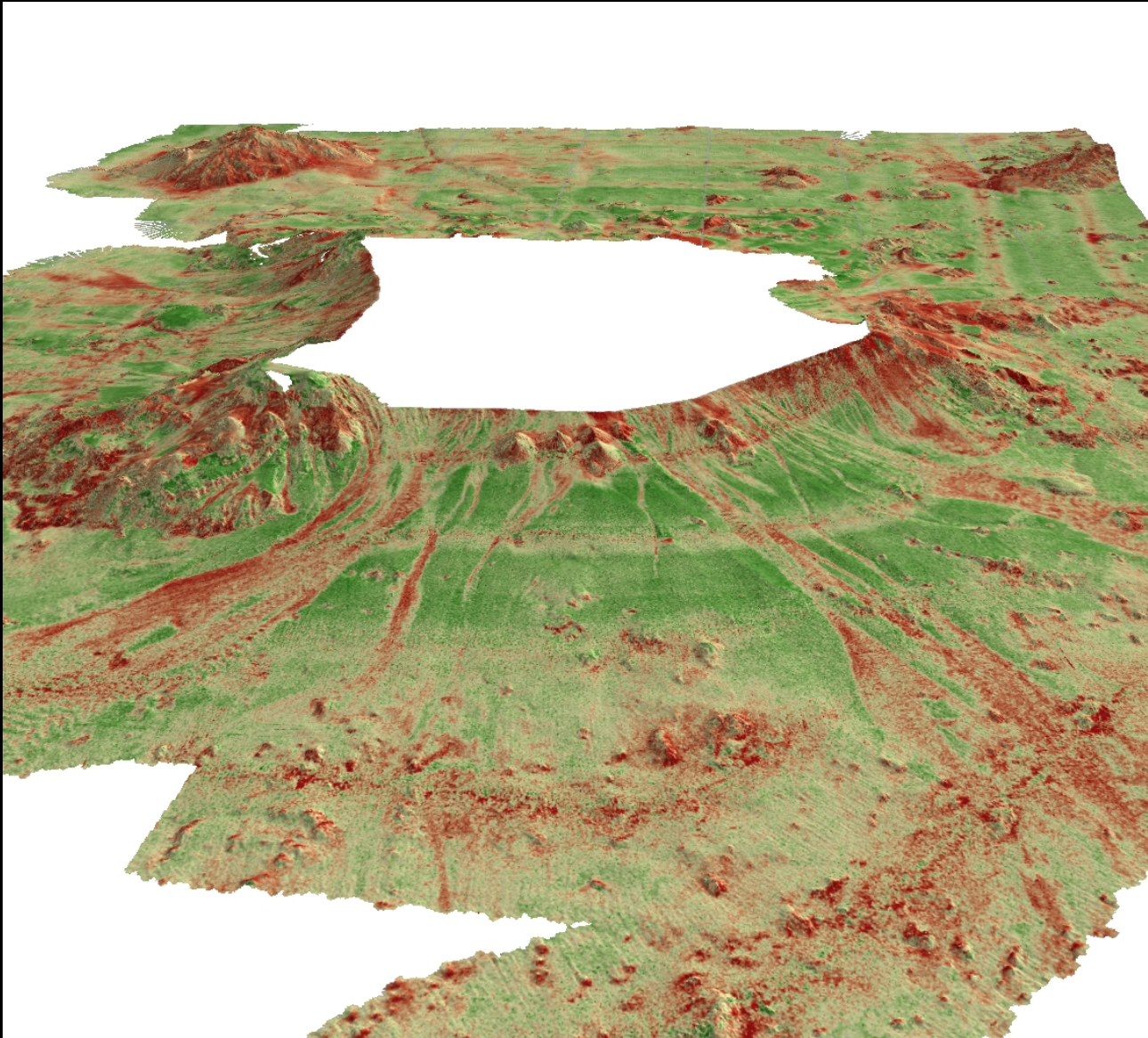
- 2 x 36-day cruises on *Falkor*
- Total Area Mapped: 127,000 km²
(7.6x area of Main HI Islands)
- Percent of Monument: 35%
- Total Data Collected: 700 Gb

-After-

Four types of features are present in the upper seamount region

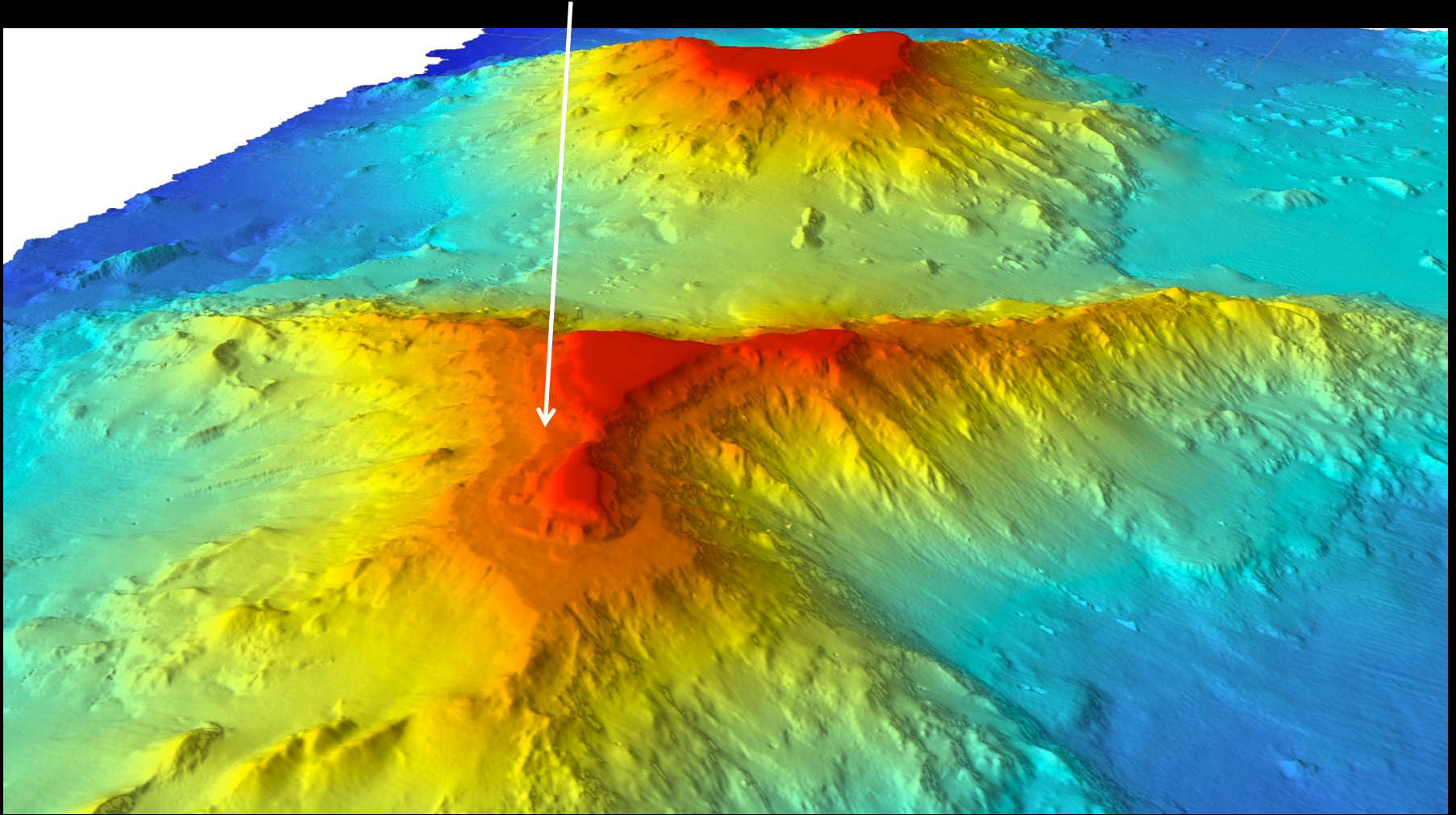


Erosional channels from Kure Atoll revealed by backscatter data



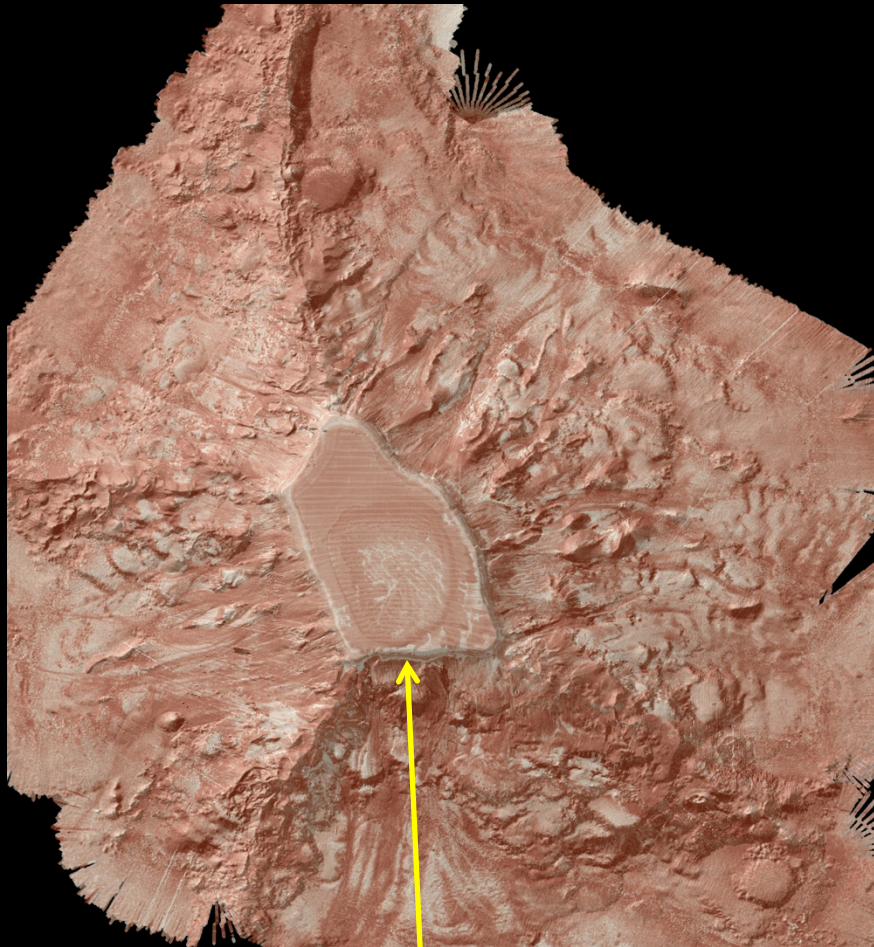
Transport of
sedimentary
material
from shallow
bank tops to
the deep
seafloor

Multiple drowned reef terraces on shallow tablemounts

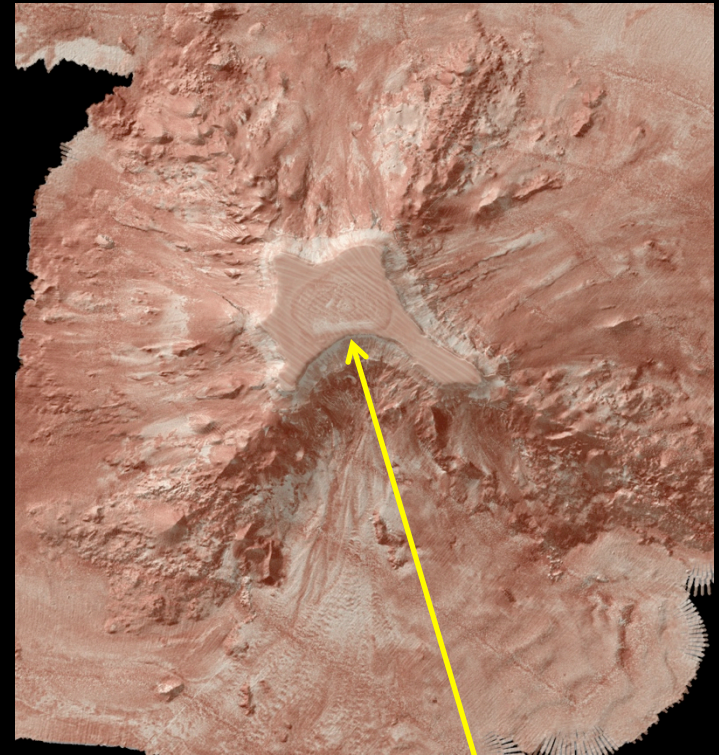


Turnif & Academician Berg Seamounts

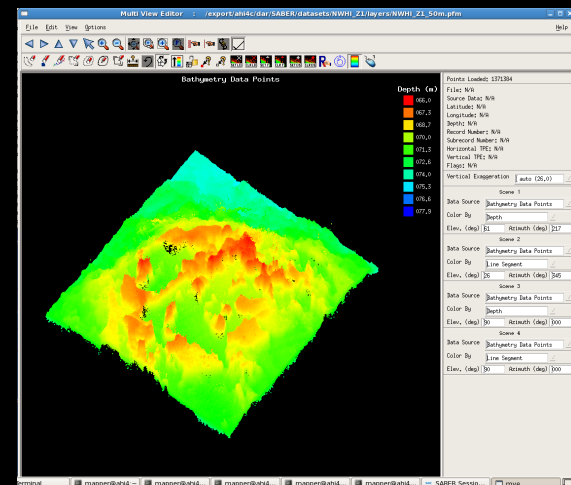
**The last reef seen in backscatter:
still alive or not?**



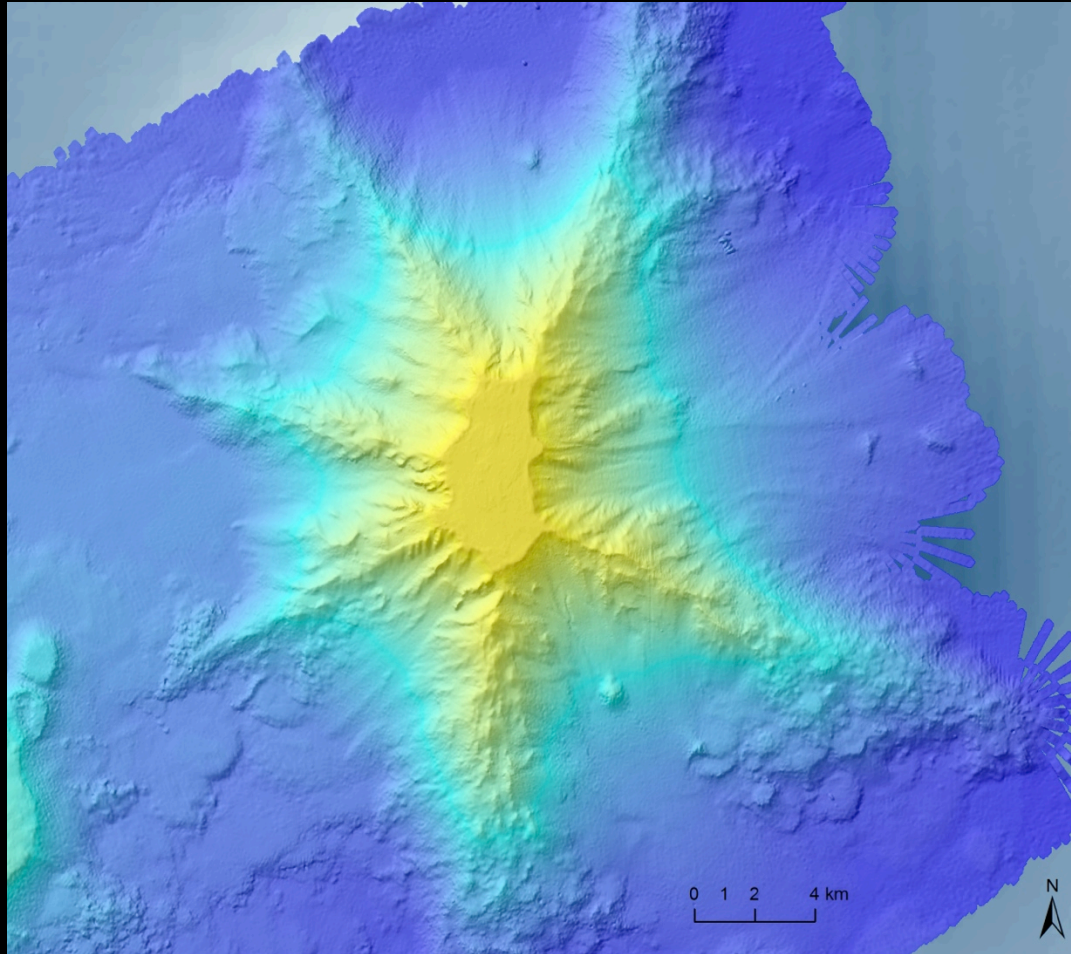
Ladd summit



Nero Summit

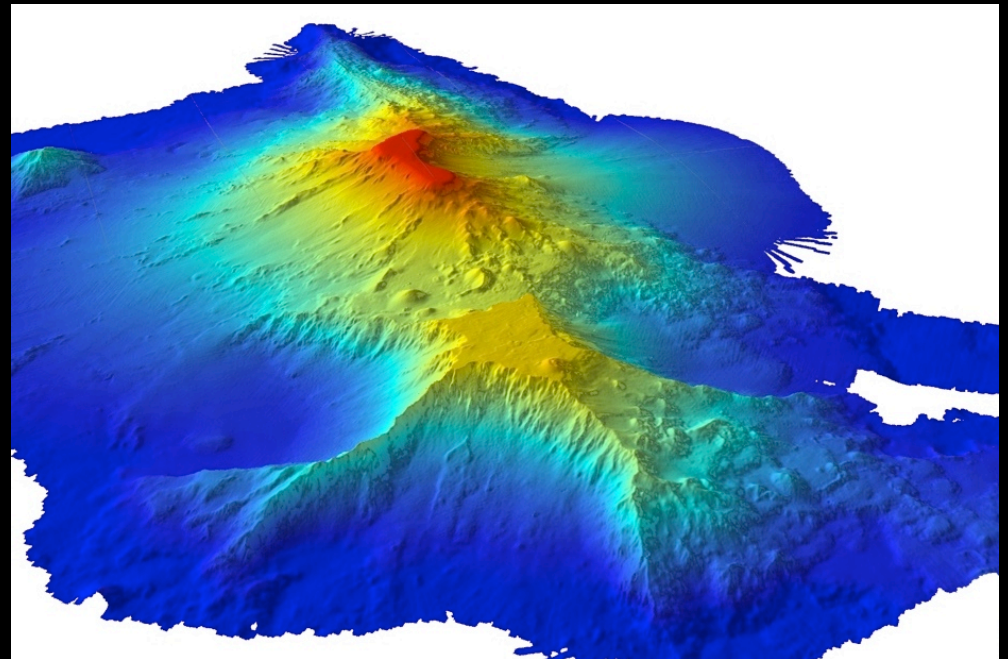
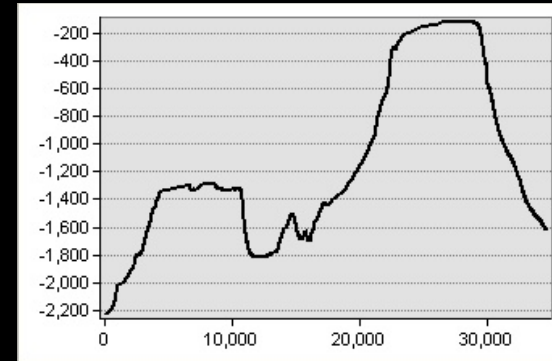
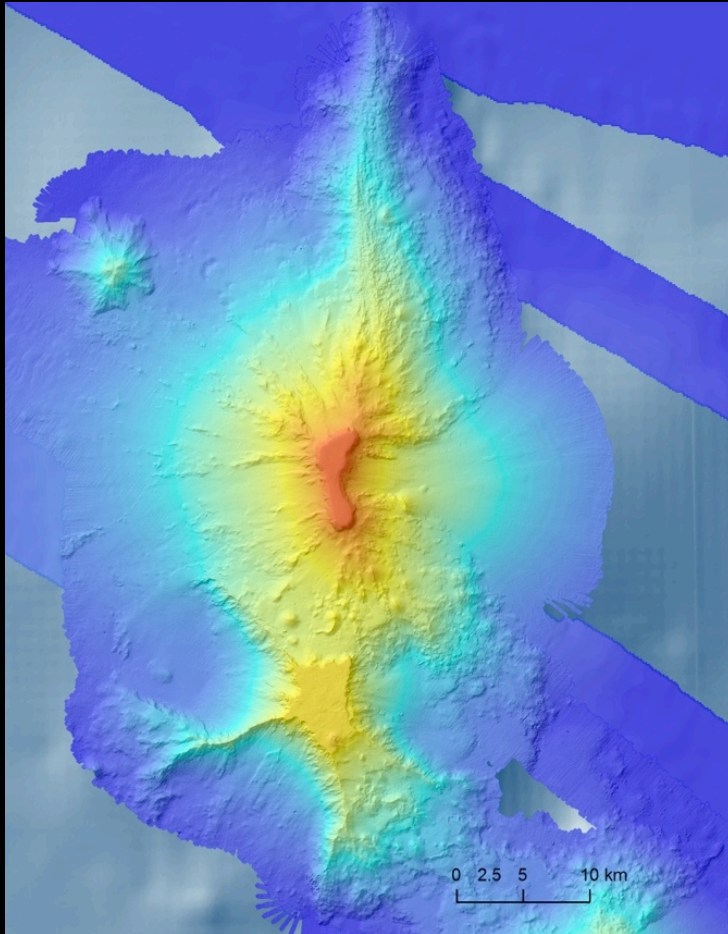


Deep tablemounts: when & where were these at the surface?

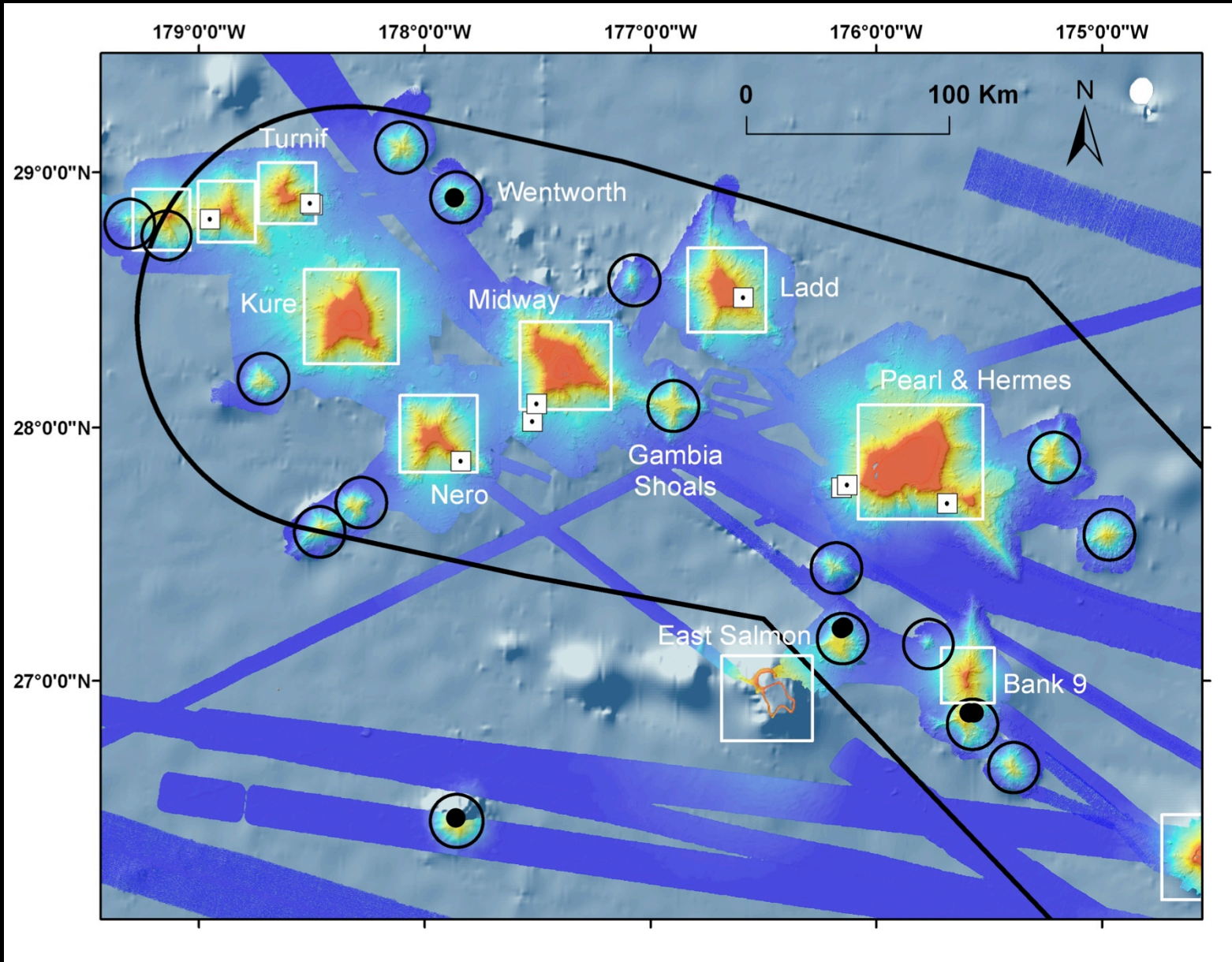


Unnamed tablemount with summit at -1500 m

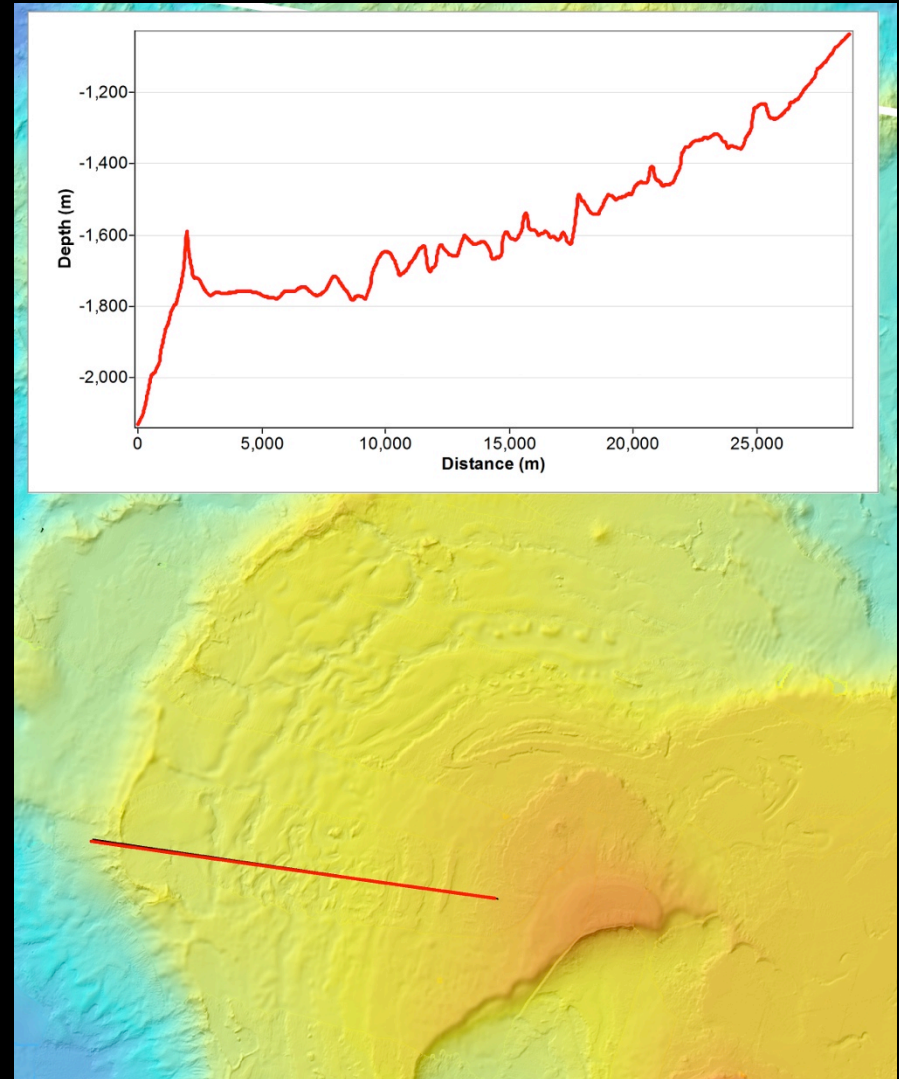
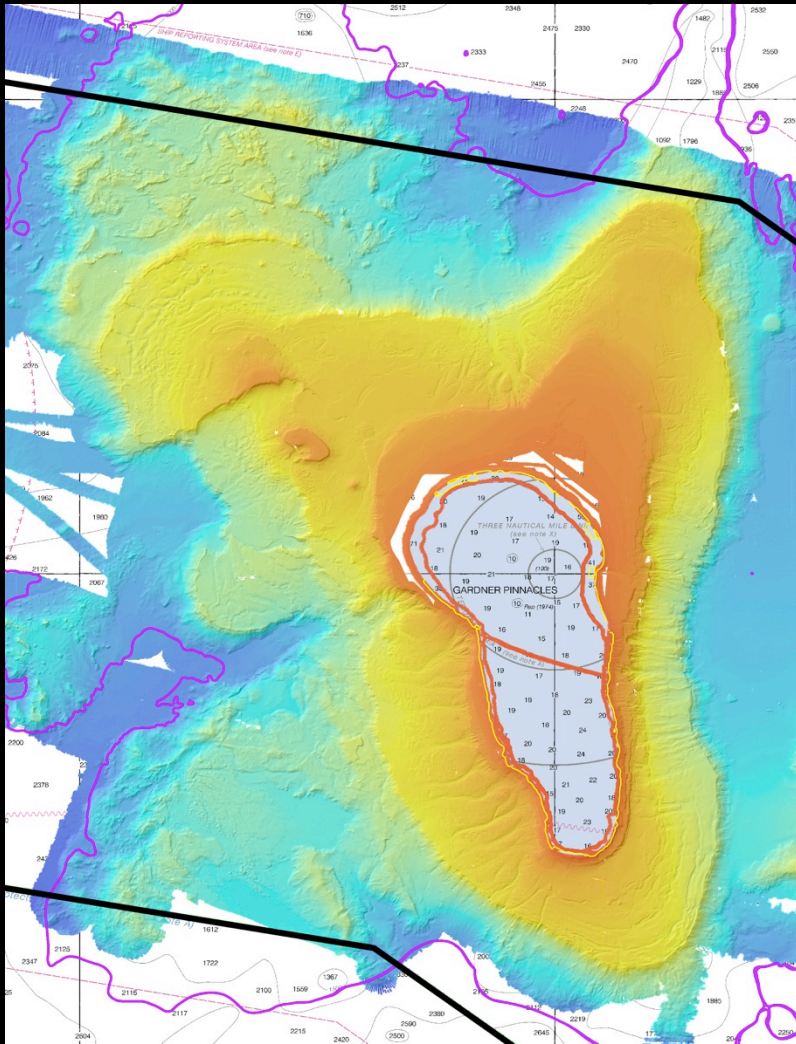
Bank 9: A composite seamount



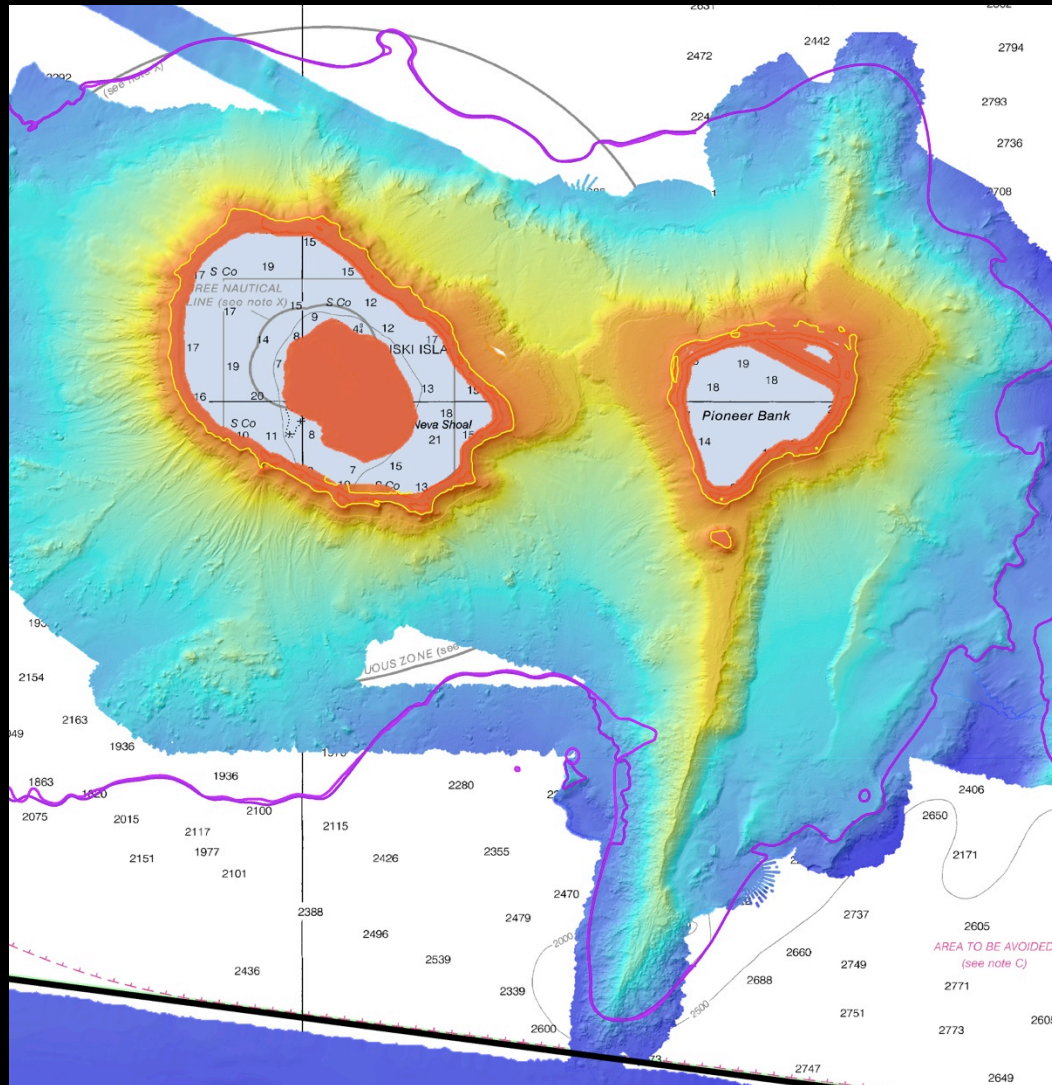
Cretaceous features circled Hawaiian features boxed



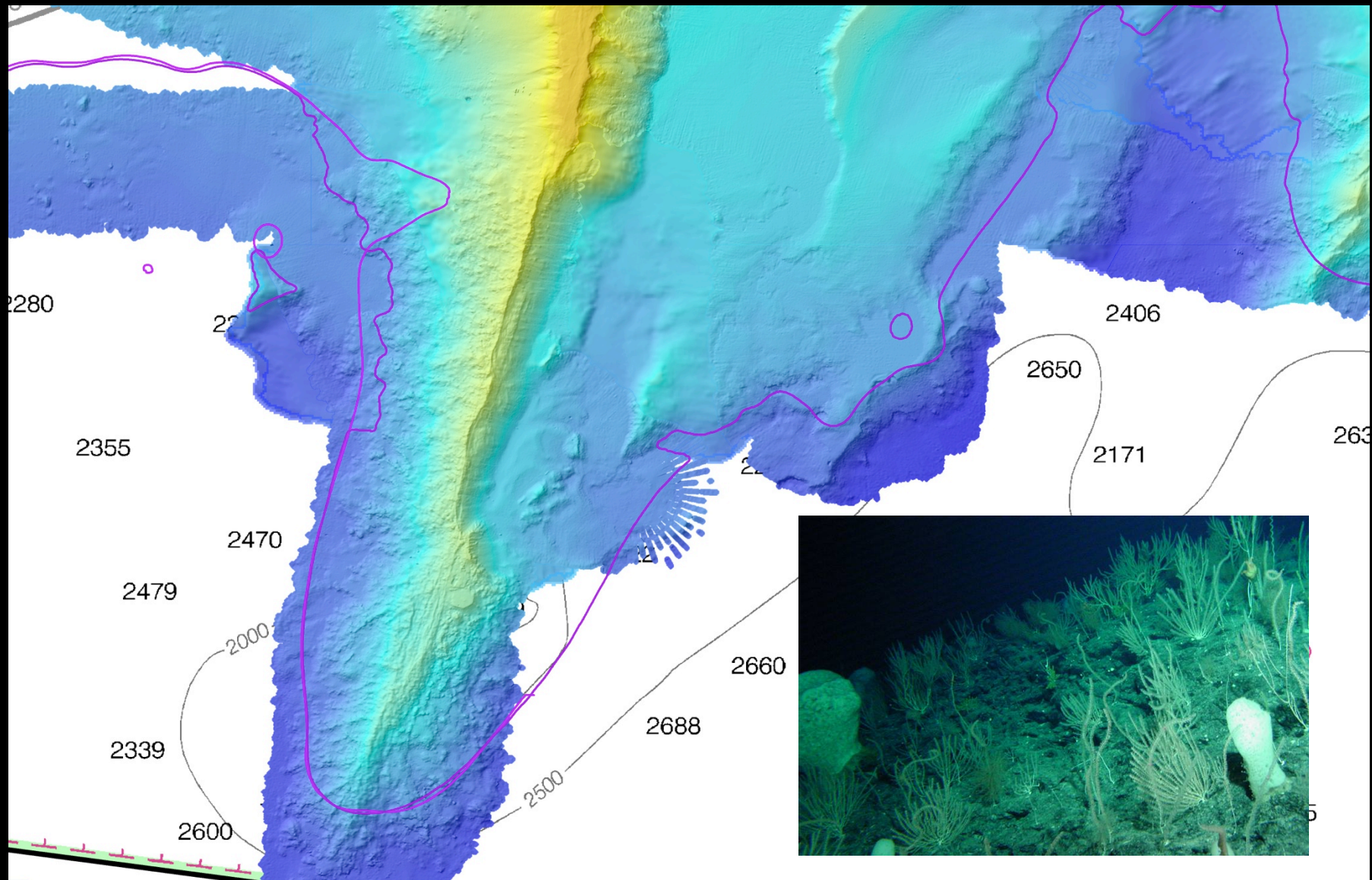
Gardner Pinnacles and an amazing drowned barrier reef



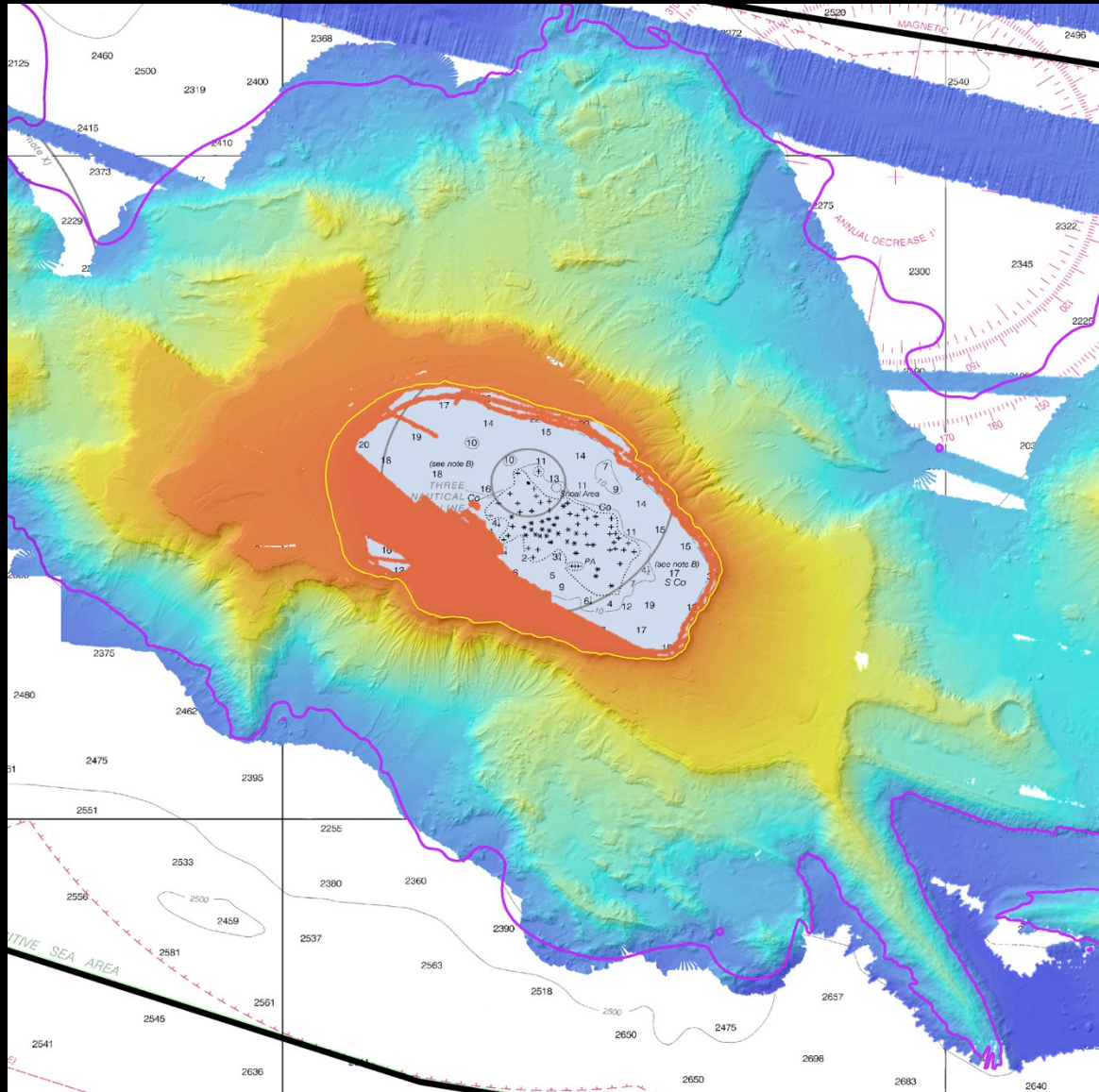
Lisianski Island and Pioneer Bank



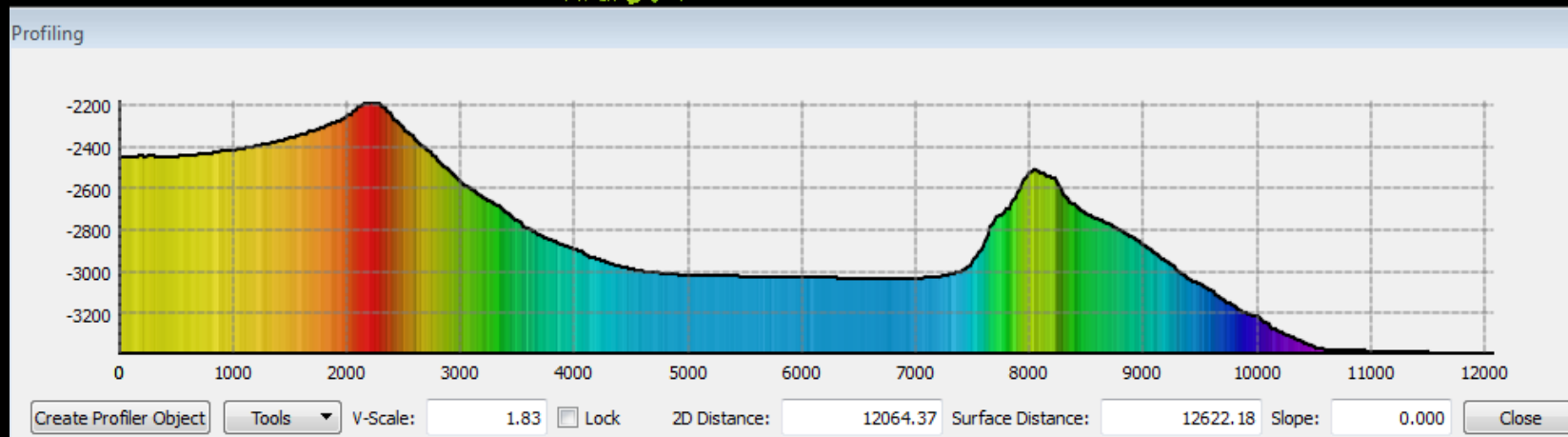
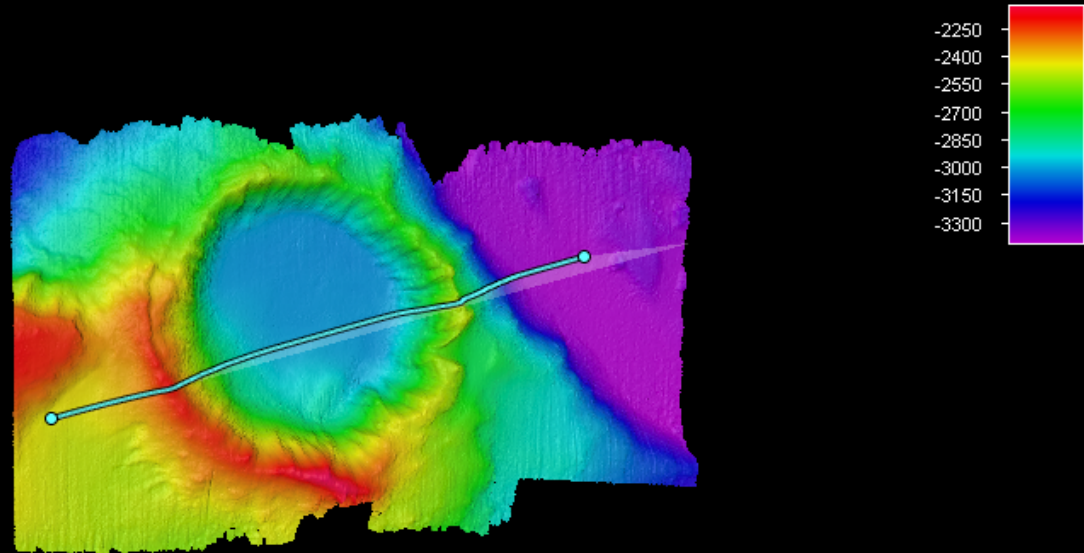
Pioneer Ridge (south rift zone) ridge flank failure



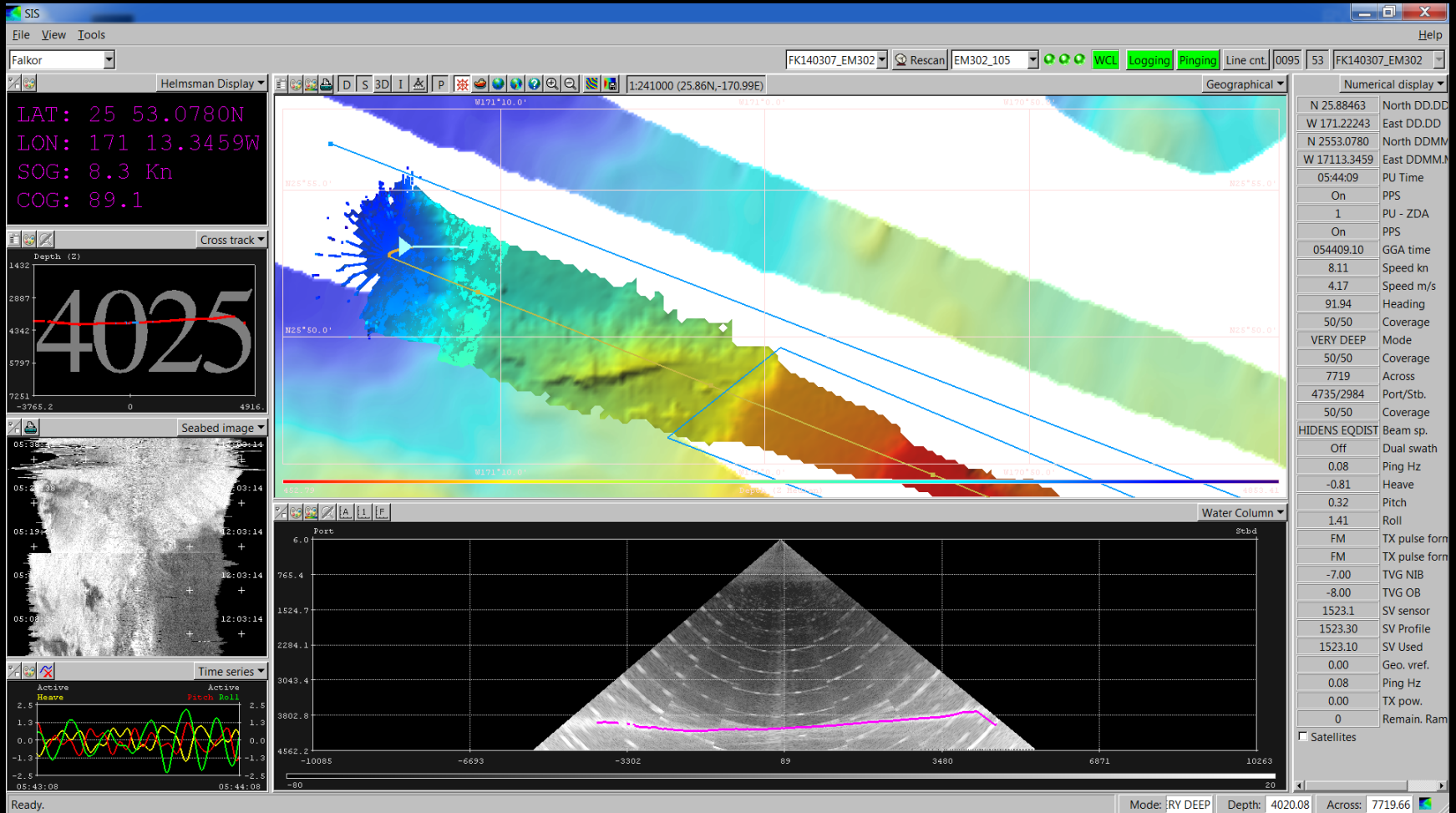
Maro Reef: an atoll falling apart



Maro's crater: the deep (and big) sister to Diamond Head?



Sperm whale interference revealed on multibeam



Tomorrow...

DI43A-4359 Spatial Distribution, Density Structure, and Relationship of
Intrusive and Extrusive Volcanics of Seamounts Along the
Northwest Hawaiian Ridge
by Jonathan Tree and others

in

Study of Earth's Deep Interior

DI43A Multidisciplinary Perspectives on Mantle Plumes: Predictions
and Observations from Source to Surface II
Thursday, December 18, afternoon
Moscone South, Poster Hall

Could Multibeam Sonar Have a Bad Effect on the Monument's Mammals?

Final report of the Independent Scientific Review Panel
investigating potential contributing factors to a 2008 Mass
stranding of melon headed whales (*Peponocephala electra*)
in Antsohihy, Madagascar

Panel Members and Report Authors*:

Brandon L. Southall, Ph.D.

Teri Rowles, D.V.M., Ph.D.

Frances Gulland, Vet. MB., Ph.D., MRCVS

Robin W. Baird, Ph.D.

Paul D. Jepson, DVM, Ph.D., Dip.ECZM

NMFS ESA Section 7 Final Recommendations for Falkor's Use of Multibeam Sonar in the Monument

- 1) Falkor must stop if marine mammals are sighted within 200 m of the ship. Falkor does not have to turn off its sonars.
- 2) The sunset recommendation was removed and Falkor can resume as soon as the mammals have cleared the 200 m exclusion zone.
- 3) A marine mammal observer must be present and observing for marine mammals during daylight hours.

Modeling Falkor's 160 dB re 1 μ Pa isopleths

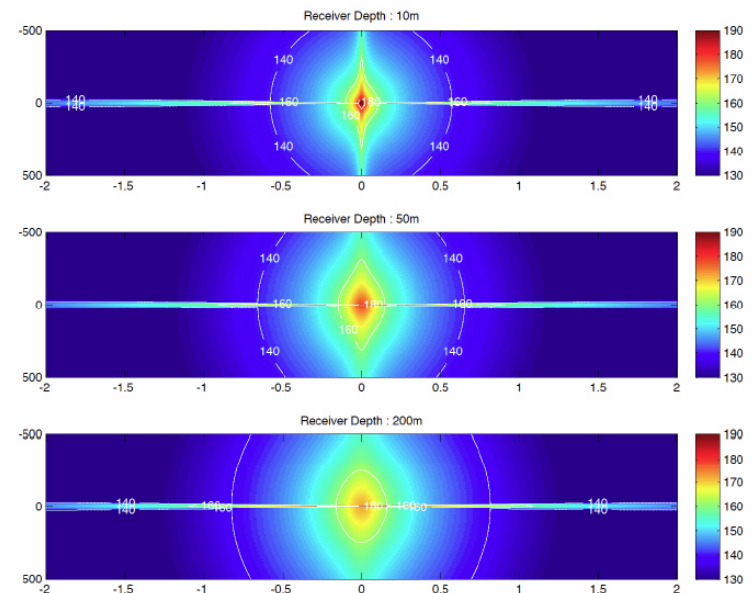
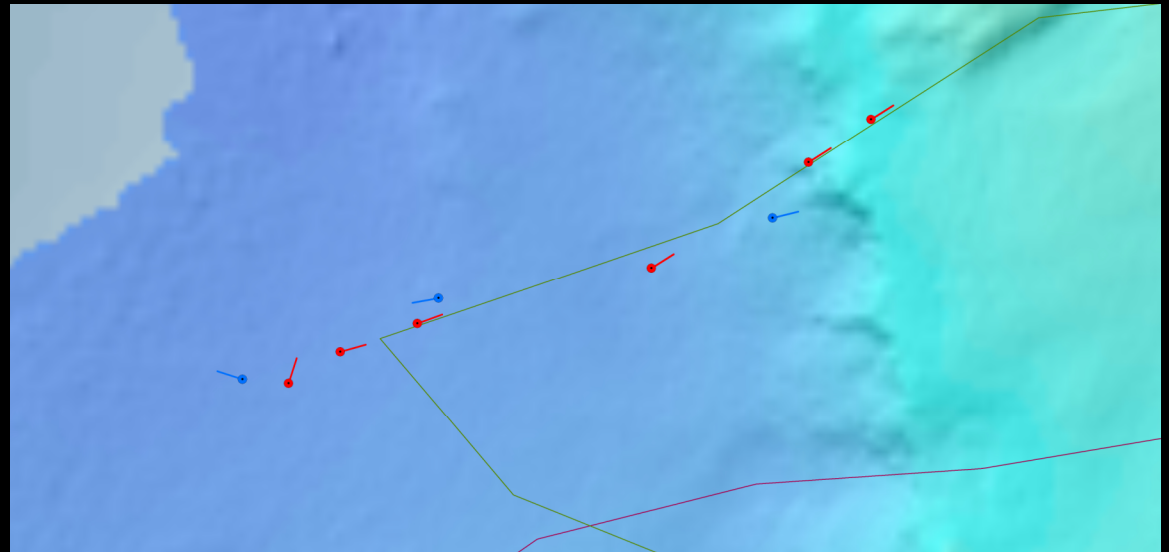
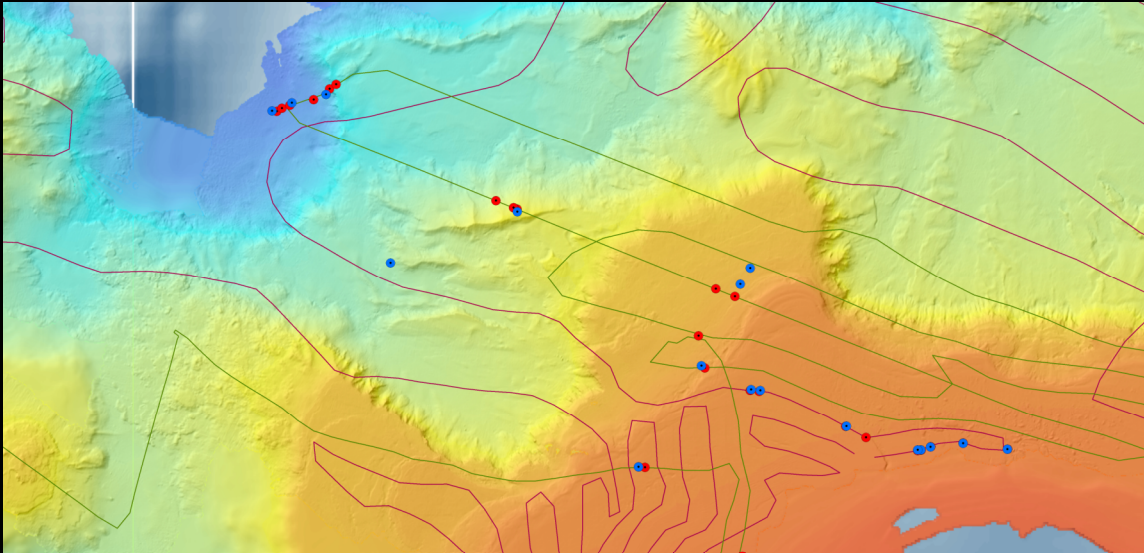


Fig. 3: Top down view image of the FALKOR EM302 radiated beam pattern at several depths (10m, 50m and 200m) created by Dr. Xavier Lurton (IFREMER). The ship track is straight up, the Y axis is distance in meters while the X axis in distance in kilometers.

ArcGIS used to map ship (red) and whale (blue) encounters



So What about the multibeam sonar and whales issue?



Pilot Whales



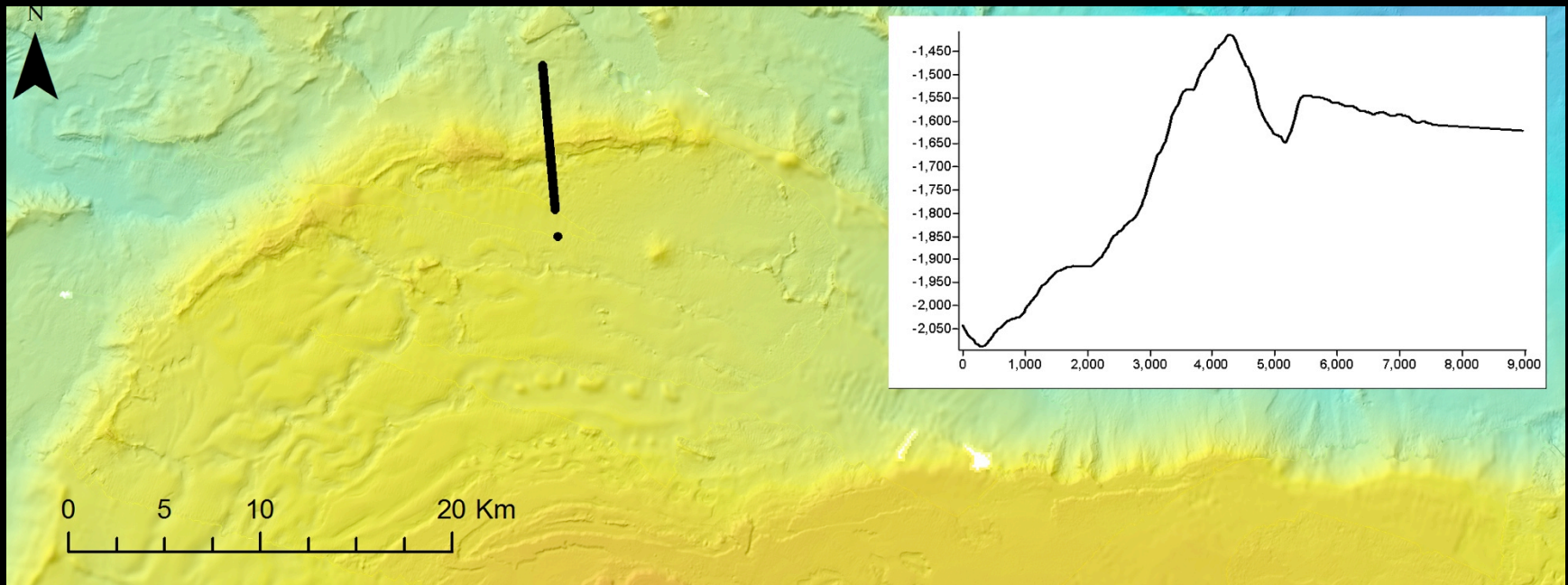
Dolphins

Sperm Whales

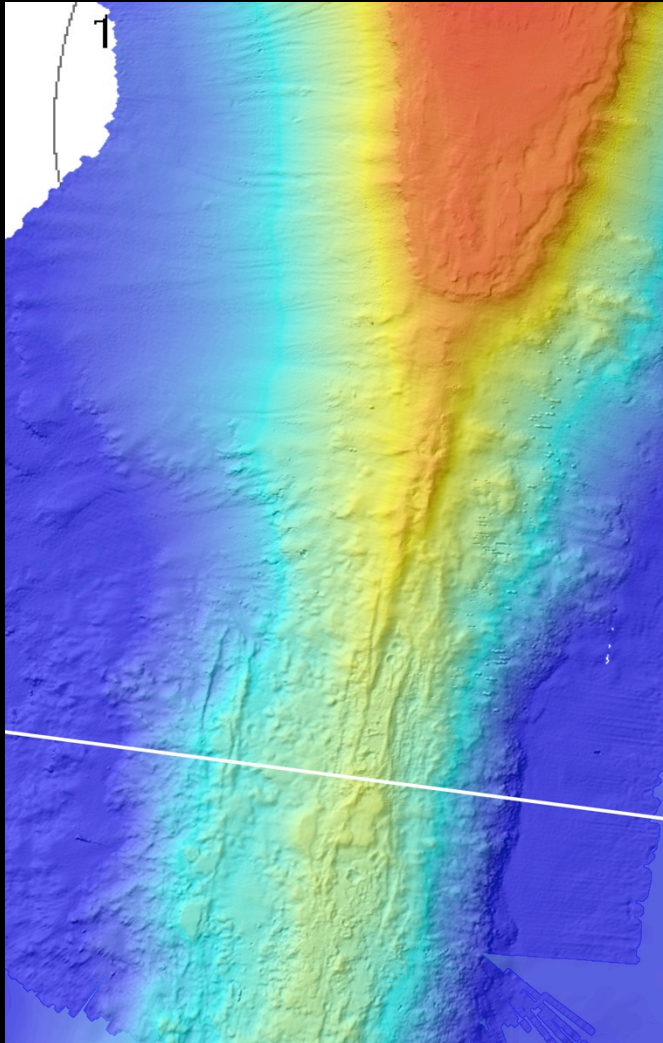
A total of 66 encounters over 72 days (less than 1/day)

Category	Species	Sightings	200m Zone	200-1000m Zone	>1000m Zone
dolphin	bottlenose dolphin	8	6	1	1
	dolphin sp	10	5	5	
	spotted dolphin	1	1		
whale	humpback whale	6		6	
	minkie whale	6		2	4
	false killer whale	3	1	2	
	orca	1		1	
	pilot whale	1	1		
	short-finned pilot whale	2	1	1	
	sperm whale	13	2	7	4
	humpback or sperm whale	1		1	
	unidentified whale	3			3
cetacean	unidentified cetacean	10	1	6	3
seal	Hawaiian monk seal	1	1		
Grand Total		66	19	32	15

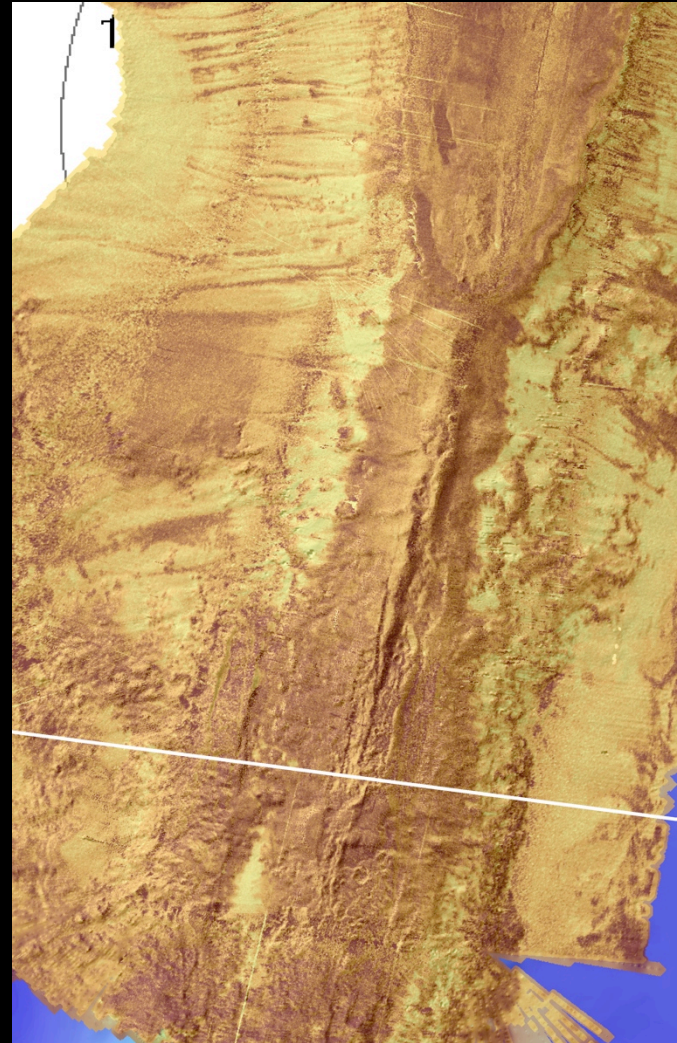
Gardner Pinnacles and an amazing drowned barrier reef



Multibeam Sonar Generates Two Types of Data

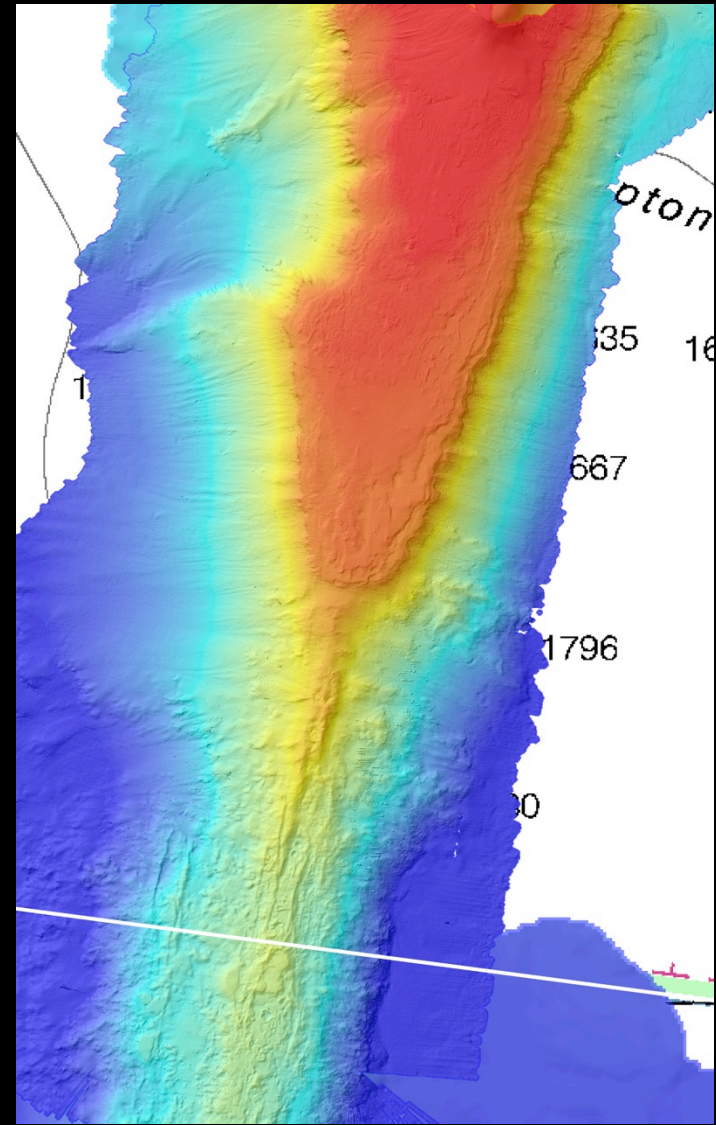
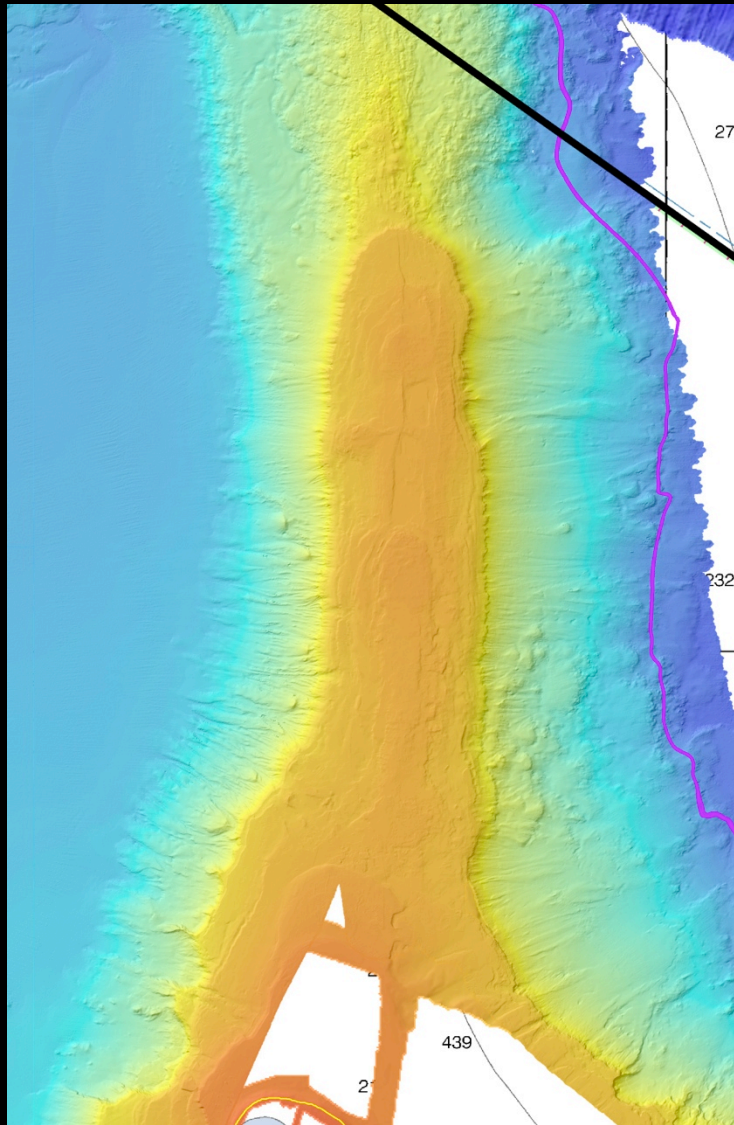


Bathymetry



Backscatter

St Rogatien and Northampton Rift Zone Ridges



Channel between Lisianski and Pioneer: serious currents

