

EXPANDING DEEP SEA HORIZONS: ABYSSAL SCIENCE PRIORITIES WORKSHOP

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NDSF NATIONAL
DEEP SUBMERGENCE
FACILITY

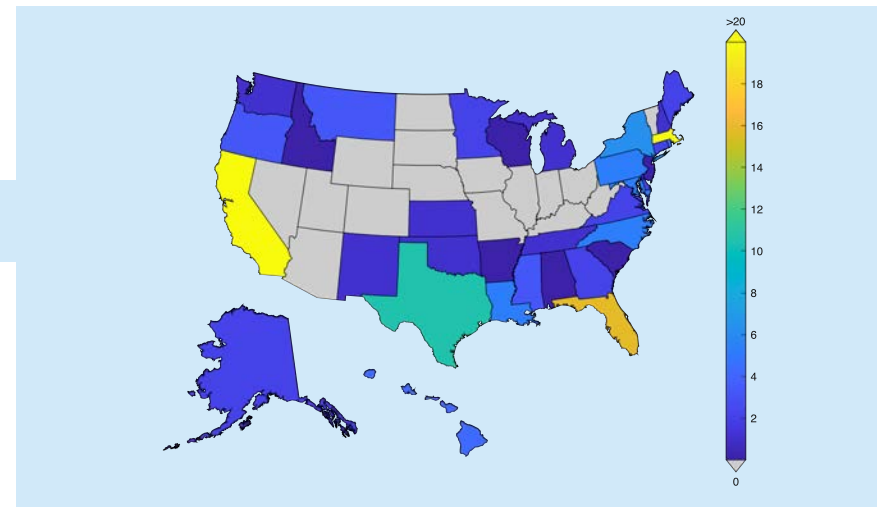


WORKSHOP OBJECTIVES

- Synthesize community input into a publication describing science priorities at abyssal depths.
- Develop a white paper outlining science verification activities for 6500m HOV Alvin.

COMMUNITY INPUT

- Online survey
- Subject-matter expert presentations
- Online community discussion



188 resp. from 34 states + International

WORKSHOP

- Workshop is held online (Zoom) in three sessions. Participants watch pre-recorded presentations and spend 90 minutes in breakout group discussion on a common set of questions.

Abyssal Plains & Seamounts

17 June (10am EDT, 2pm PDT)

- Peter Auster, U Conn
- Jill McDermott, Lehigh U
- Steve D'Hondt, GSO URI
- Jasper Konter, SOEST U Hawaii

[>150 registered]

Trenches & Transforms

30 June (10am EDT, 2pm PDT)

- Chris German, WHOI
- Karyn Rogers, RPI
- Patty Fryer, SOEST U Hawaii
- Jeff Drazen, SOEST U Hawaii

Technology & Societal Relevance


07 July (10am EDT, 2pm PDT)

- Bruce Strickrott, WHOI
- Pete Girguis, Harvard U
- Beth Orcutt, Bigelow
- Diva Amon, NHM London

Pre-Workshop Materials

Peter Auster, UConn

Seamounts ... where are they?



Total Seamounts = 100,000+
50,000+ are >1000 m, many more <1000 m
Area < 2000 m is < 10% of all High Seas Region

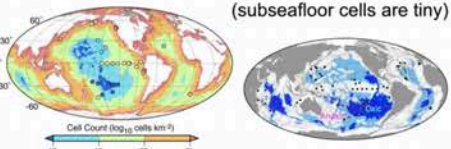
From The Sea Around Us Project, 2006

Steve D'Hondt, GSO URI

Sedimentary microbes are abundant

- Roughly equal to total numbers in seawater &
- <1% of Earth's total biomass

(subseafloor cells are tiny)



Cell Count (\log_{10} cells km^{-2})

Total = 2.9×10^{29} cells

Abundant in anoxic sediment. Sparse in oxic sediment.

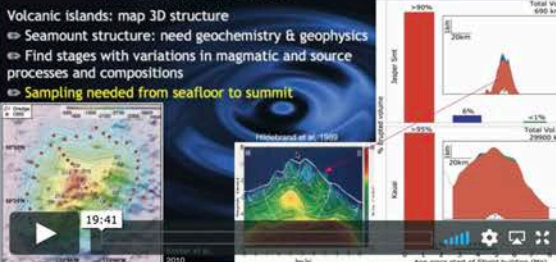
Jasper Konter, SOEST UH

Science in the Abyss Workshop Jasper Konter #AbyssalScience Hotspot

Construction in Stages

Volcanic islands: map 3D structure

- ⇒ Seamount structure: need geochemistry & geophysics
- ⇒ Find stages with variations in magmatic and source processes and compositions
- ⇒ Sampling needed from seafloor to summit



Age since start of shield building (Ma)

Jill McDermott, Lehigh Univ

Science in the Abyss Workshop McDermott #Abyss

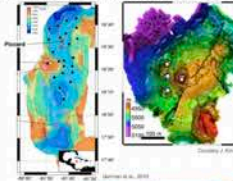
Ashadze-1, Aurora, and Piccard; slow to ultra-slow mid-ocean ridges

Abyssal site: 4900 m Piccard vent field; German et al., 2010; Connolly et al., 2011; McDermott et al., 2018

Description: Black smoker field hosted in basalt flows, 398°C

Select scientific discoveries:

- Newly discovered allochroicid shrimp species, *Rimicaris byrdiae* (Wynn et al., 2012)
- Biomass pyrolysis origin of methanethiol (Peeves et al., 2014)
- Although the measured maximum temperature of 398°C is below the two-phase boundary of seawater at seafloor conditions, several lines of evidence suggest that these fluids cooled from much higher temperatures at depth, >500°C (McDermott et al., 2018)
- These high temperatures of formation produce very high aqueous H₂ contents that exceed those at many ultramafic fields (McDermott et al., 2018)



DIVERSITY, EQUITY, AND INCLUSION

- The nationwide protests have illuminated the challenges we face in science with DEI. We have reserved a portion of our discussion time in the workshop session focused on 'Societal Relevance' for this topic.
- We are working towards adding a fourth session to the workshop that deals exclusively with systemic racism in the sciences and approaches to address diversity, equity, and inclusion within our community. KnowInnovation, who is facilitating the digital side of the workshop offered to support this fourth workshop *pro bono*.

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NDSF Technology Update: Other

- DS_ROS
- Rapidly expanding to more vehicles, NDSF, NSF general, ONR, ARPA-E, OTZ, NUWC Keyport, ???
- Two way street NDSF contributes and receives modules
- Must solve the divergence and maintenance problem
- Centralize and then interconnect domain knowledge
- First Project DVL Standardization – kick off soon
- Software and Data
- Common Code, Workflows, Hardware, and People
- Auto QA/QC/Configuration Management
- Reduce errors, catch errors earlier, reduce training
- Better Error tracking, reporting, and analysis
- Common Technology – Make using common tech the default not the goal
- Power supplies, hotel hardware, imaging, topside support, etc
- Simulation and training – more of a far field initiative but potentially highly valuable