FUTURE 2024

FUTURE of US Marine Seafloor & Subseafloor sampling capabilities workshop
March 26-28, Woods Hole, MA

- Masako Tominaga (WHOI)
- Maureen Walczak (UW)
- Brendan Reilly (LDEO)
- Kevin Konrad (Oregon State Univ.)
- Matt Schrenk (Michigan State Univ.)

FUTURE 2024 Workshop PIs (NSF OCE #2341096)

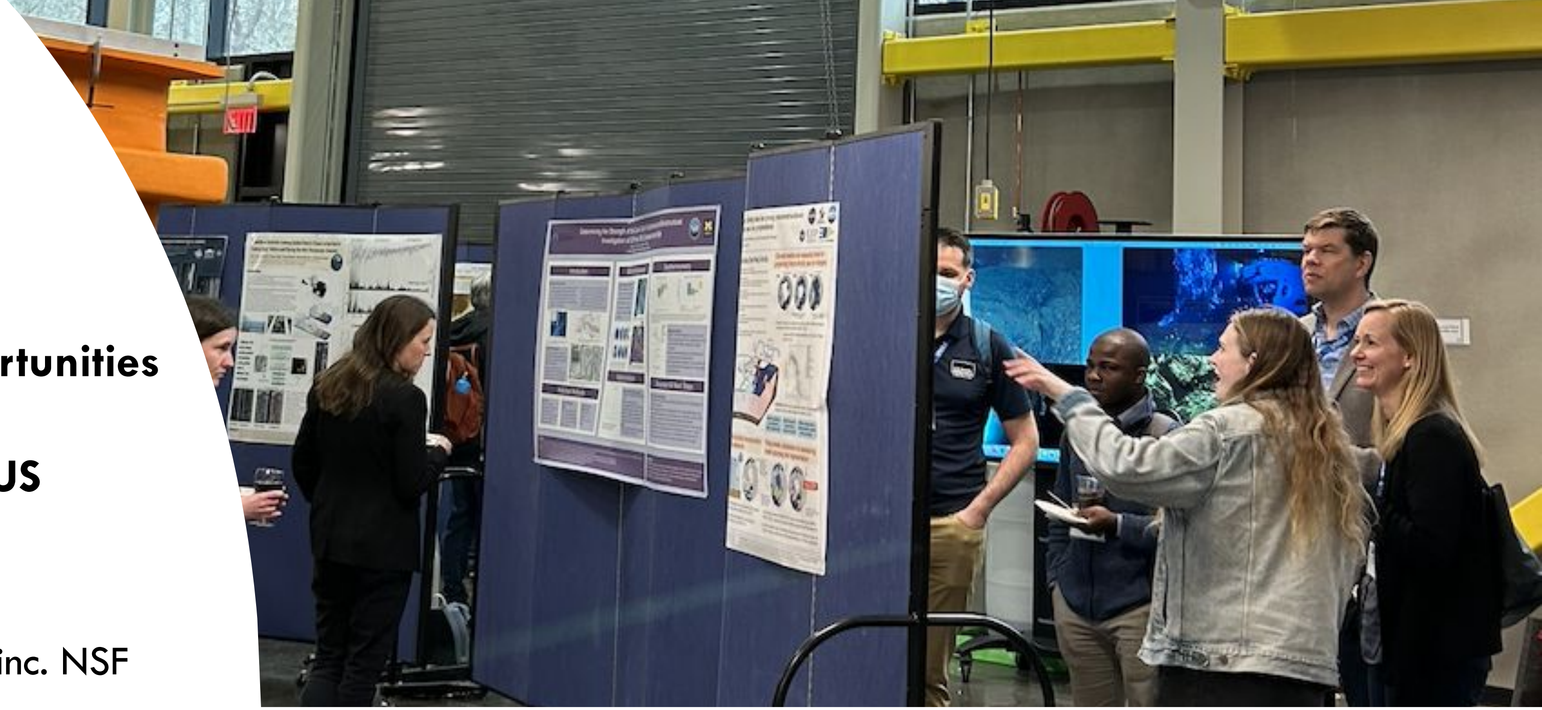
Sharing knowledge

while enlightening collaborative seafloor/subseafloor sampling research opportunities among generations, science disciplines, and science/engineering/operations teams in the US

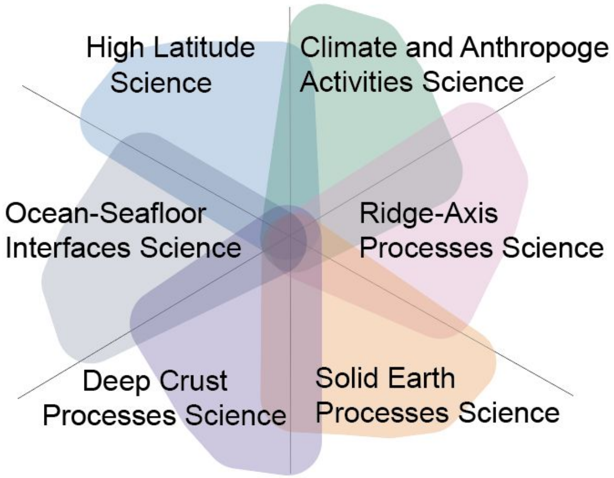
- 132 in-person participants from 63 US Institutions. (inc. NSF PDs (5), speakers (10) +Future 2024 PIs (5))

  "Early Career Scientists" (=~ 52 %))
  - 25 of them are obtaining PhD 2024~
  - 31 of them obtained PhD 2012-2023

- 68 remote participants from both US and non-US Institutions.



SCIENCE-DRIVEN ASSESSMENT OF THE US OCEANOGRAPHIC/SAMPLING CAPABILITIES



- **Day-1:** Critical science questions that require seafloor sampling.
- **Day-2:** Aligning seafloor sampling technology with critical science questions.

WORKSHOP OUTCOMES:

The FUTURE of the US marine seafloor & subseafloor sampling capabilities

(revision submitted to AGU Advances)

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8: Colorado School of Mines
9: Japan Agency for Marine Science and Technology
10: University of Bremen, MARUM, Germany
11: Cornell University
12: Boise State University
13: Florida Atlantic University Harbor Branch Oceanographic Institute
14: College of Charleston
15: University of New Haven
16: Montana Technological University
17: Northern Illinois University
18: University of Maryland
19: George Mason University
20: University of California Santa Barbara
21: Texas A&M University, College Station
22: Montclair State University
23: University of Texas, Austin
24: Byrd Polar and Climate Research Center, Ohio State University
25: NOAA Ocean Exploration
26: Florida State University
27: Bowling Green State University
28: Binghamton University
29: International Ocean Discovery Program, Texas A&M University
30: University of Alaska, Fairbanks
31: Boston University
32: University of Chicago

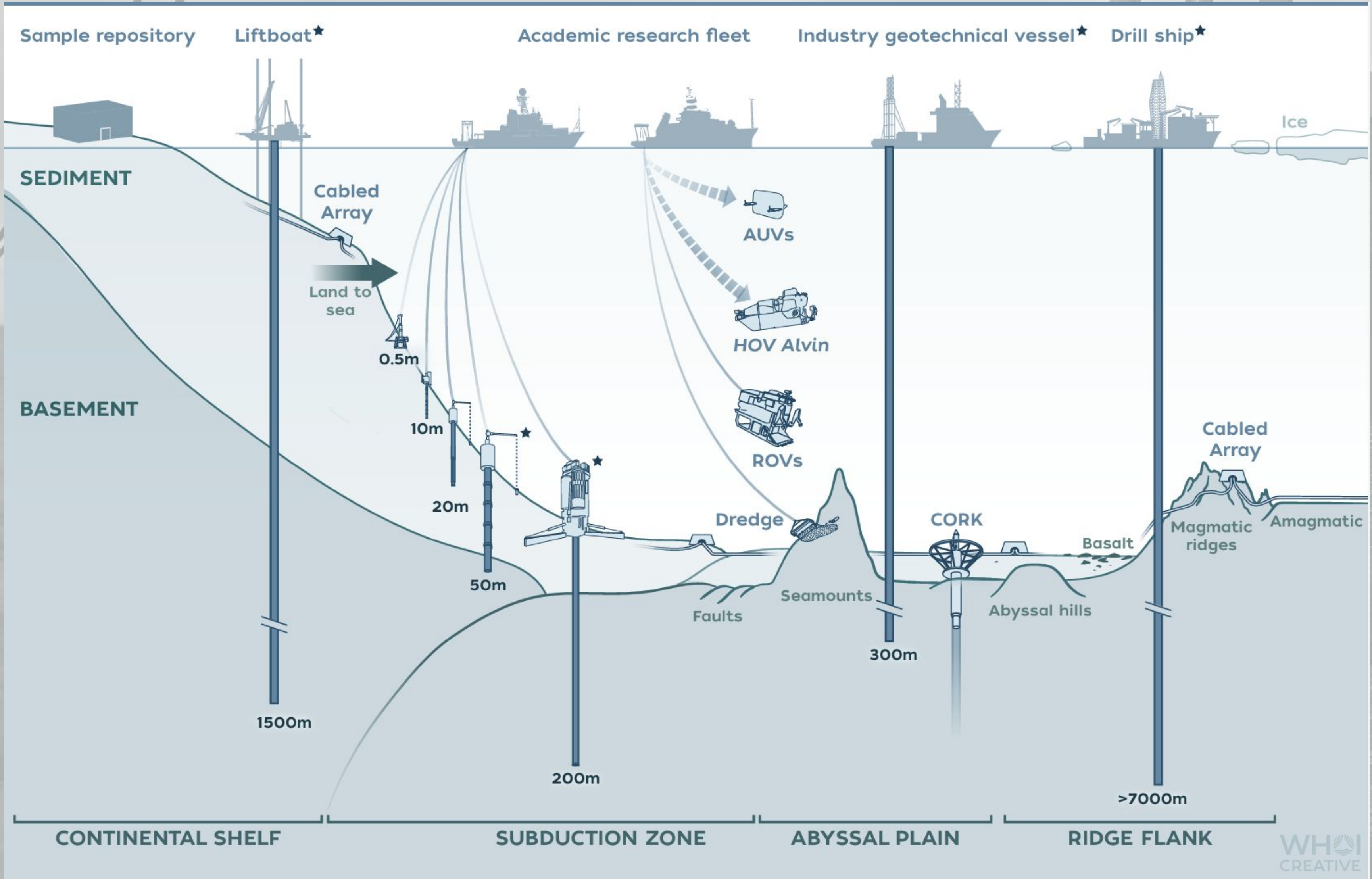
Currently *in revision* to AGU Advances.
50 co-authors from 32 Institutions – many are ECRs from writing hackathon effort in Day-3.

		Ocean-Seafloor Interfaces	Climate and Anthropogenic Activities	Deep Crust Processes	Ridge Axes Processes	Solid Earth Processes	High-latitude Sciences
Research Vessel and Associated Infrastructure Capabilities that Enable Seafloor Sampling	Overboarding capabilities up to 16,500 lb SWL	R	R	R	R	R	R
	Overboarding capabilities up to 200,000 lb SWL	R	R	R	R	R	R
	Seafloor and subseafloor characterization (multi-beam, back scatter, chirp sonar)	R	R	R	R	R	R
	High resolution with precision navigation seafloor processes characterization (by AUV/ROV/HOV, and TowCam)	R	R	NMC	R	R	D
	High resolution subseafloor imaging (<5 to ~200 m below seafloor)	D	R	R	D	R	R
	Deep subseafloor imaging (>1000 m below seafloor)	NMC	D	R	R	R	R
	Seafloor cabled arrays (sensors, power in focused areas like OOI RCA)	R	NMC	R	R	D	D
	Refrigerated laboratory space	R	R	R	R	D	R
	Radioisotope-safe laboratory space	R	D	R	R	D	D
	Trace-metal clean laboratory space (e.g., lab van)	R	D	R	R	NMC	D
	Shipboard multi-sensor core logger	D	R	R	D	D	R
	Shipboard CT/x-radiograph imaging	D	R	R	D	D	R
	USBL (ultra short baseline) navigation and dynamic positioning for the widest range of vessel classes	R	R	R	R	R	R
	Polar aircraft	NMC	NMC	NMC	NMC	NMC	R
	Polar class < 5 capabilities and/or ice breaker	R	R	D	D	D	R
Seafloor Sampling Capabilities	Dredging/wax coring (seafloor surface rock samples)	NMC	NMC	R	R	R	D
	Dredging > 5000m water depths	NMC	NMC	R	R	R	NMC
	Grab/Bio Samplers	R	D	NMC	NMC	NMC	R
	Multi-coring/Slow-coring (sediment/water interface)	R	R	NMC	D	D	R
	Box/Soutar corers (large volume surface sediments)	R	R	NMC	NMC	NMC	R
	Kasten corers (large volume up to 3 meters)	D	R	R	R	R	R
	Gravity corers (2" or 4" diameter cores up to 20 m)	D	R	R	R	R	R
	Piston corers (2" diameter corer up to >30 m)	NMC	D	D	D	D	R
	Jumbo piston corers (4" diameter corer up to 30-40 m)	NMC	R	R	R	R	R
	Giant piston corers (4" diameter corer up to 40-50 m)	NMC	R	R	D	D	R
	Lander-style robotic drills** (3"+ diameter cores, holes up to ~200 m)	NMC	R	R	R	R	R
	Expanded capabilities of AUVs, including efficient access to a wide range of shallower water (10-4000m) depth	R	R	R	R	R	R
	ROV/HOV Hosted Seafloor (rock) drill	D	NMC	NMC	R	R	NMC
	ROV/HOV Hosted Seafloor push corer	R	NMC	NMC	R	R	R
	CORKs/seals/observatories/sensors	NMC	NMC	R	R	R	D
	Gas/Fluid samplers (H2O, CH4, H2, Oxygen, etc.)	R	D	R	R	D	D
	Logging/geotechnical tools operable from ARF to access legacy holes	D	D	R	R	R	D
	Scientific Drilling platform/vessels (4"+ diameter cores, holes >1000 m, water depths at least > 6000m)	R	R	R	R	R	R

Blue : currently available - inc. elsewhere if not in US
Green : next emerging needs/low risk (low budget) ~ 1 yr funding cycle
Yellow : intermediate - during the corporate agreement period (~ 5yrs)
Orange : longer term

WORKSHOP OUTCOMES:

ASSESSING SEAFLOOR/SUBSEAFLOOR SAMPLING CAPABILITIES



Chris Lowrey and Masako Tominaga, Illustrated by Charin Park. ©Woods Hole Oceanographic Institution

WORKSHOP OUTCOMES:

- Vessel's over-boarding capabilities
  - Reestablishing a longer piston coring system
  - Achieving 5000m+ dredging capability
  - Establishing US lander-style seafloor robotic coring systems
- Expanding underwater robotic capabilities (AUVs and ROVs)
- Maximizing the value of returned samples
- Advancing science through the torch relay of institutional knowledge

ACKNOWLEDGEMENT

NSF

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ONR
Science & Technology

UNOLS
UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM