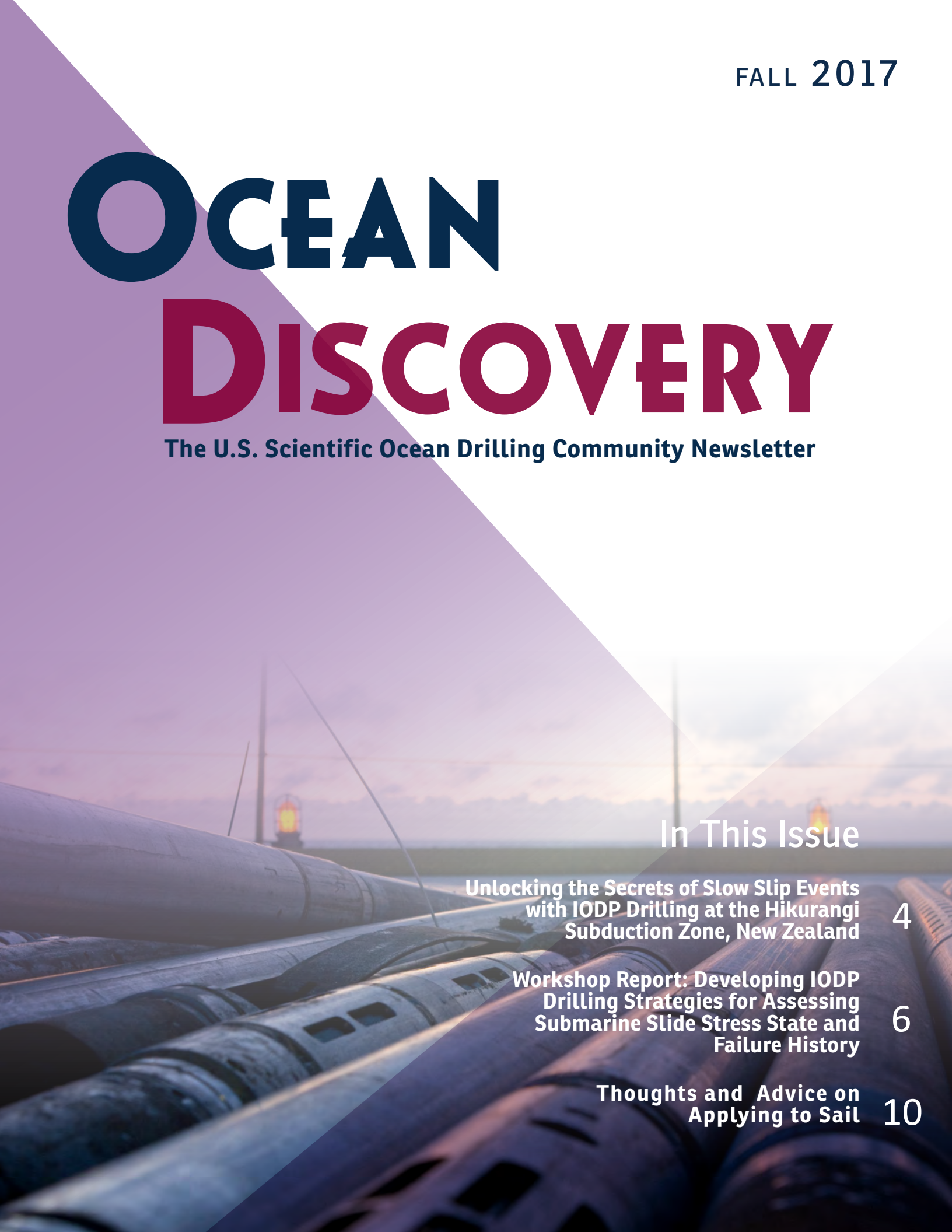
FALL 2017

Ocean Discovery

The U.S. Scientific Ocean Drilling Community Newsletter



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The International Ocean Discovery Program (IODP) is an international research collaboration among roughly two dozen countries to advance scientific understanding of the Earth through drilling, coring, and monitoring the subseafloor. The U.S. Science Support Program (USSSP) supports the involvement of the U.S. scientific community in IODP and is funded by the U.S. National Science Foundation (NSF). IODP utilizes multiple drilling platforms to carry out its missions: the riserless *JOIDES Resolution*, managed by Texas A&M University; the riser-equipped *Chikyu*, operated by the Center for Deep Earth Research (CDEX), a subdivision of the Japan Agency for Marine-Earth Science and Technology (JAMSTEC); and various mission-specific platforms operated by the British Geological Survey on behalf of the European Consortium for Ocean Research Drilling (ECORD). For more information, visit: www.iodp.org.

To contact the editor of *Ocean Discovery*, email: jspencer@LDEO.columbia.edu; or call 845-365-8785

For more information about USSSP, visit: usoceandiscovery.org/what-is-usssp

CALENDAR

December

11-15 American Geophysical Union Fall Meeting (IODP Town Hall, 13 December)
New Orleans, LA

January

9-11 Science Evaluation Panel
La Jolla, CA

Jan 12-Feb 24 Core-Log-Seismic Investigation at Sea during IODP Expedition 380
Onboard *D/V Chikyu*

February

20-22 U.S. Advisory Committee for Scientific Ocean Drilling
Bellingham, WA

March

6-7 ECORD Facility Board
Venice, Italy

19-20 *Chikyu* IODP Board
Kobe, Japan

23-27 ECORD Training Course 2018: Virtual Drillship Experience
Bremen, Germany

April

8-13 European Geophysical Union Meeting
Vienna, Austria

May

15-16 *JOIDES Resolution* Facility Board
Alexandria, VA

20-24 Japan Geophysical Union – American Geophysical Union Joint Meeting
Chiba, Japan

Letter From the Science Evaluation Panel Co-Chairs

Dear Colleagues,

This letter is intended to provide a general update on the International Ocean Discovery Program (IODP) proposal evaluation system and a request to keep the great proposals coming. With the transition from the Integrated Ocean Drilling Program to the current program, the panel system for evaluating drilling proposals was streamlined. Now a single panel, the Science Evaluation Panel (SEP), meets in January and June to evaluate proposals submitted to the IODP Science Support Office on either April 1st or October 1st, with associated geological and geophysical data submitted to the Site Survey Data Bank on May 1st and November 1st, respectively. Every proposal is assigned five watchdogs: two to evaluate the science, two to evaluate the suitability of each proposed drill site to accomplish the science goals using site characterization data, and one to evaluate and advise on the feasibility of drilling and technical capabilities to accomplish the proposed objectives using the *JOIDES Resolution*, *Chikyu*, or a mission specific platform (MSP).

We are pleased to say that this system is not only working well to nurture proposals into readiness, but also to identify key issues in the compatibility of science proposed and site characterization at an early stage. The net results are that 88 proposals were submitted for the new program (as of Sep. 2017) and 14 proposals were implemented or scheduled, with the mean time from pre-proposal to scheduling reduced to 4.5 years. Though we continue our history of fostering proposals, we maintain a rigorous review process, deactivating around 45% proposals, with many being resubmitted with an improved strategy at a later date. We have been receiving around 15-20 proposals at each deadline, which is healthy, though an increase in proposal pressure would be welcome. We encourage submission of pre-proposals, full proposals, and Ancillary Project Letters (APLs) that provide great flexibility by allowing requests for drilling of a few days in areas where drilling is already planned. (Also keep in mind that you are free to submit drilling proposals that require less than 60 days to conduct.)

We would like to specifically encourage the submission of proposals for ocean basins that the JR is planning to venture into, with the immediate focus on the North Atlantic and eventual plans to return to the Indo-Pacific. (See the graphic of the proposed *JOIDES Resolution* ship track on page 12.) Once the JR transits back through the Panama Canal in 2022 or 2023 it would be ideal to have a selection of mature proposals ready to drill in the North Pacific, South Pacific, Southern Ocean and Indian Ocean regions. Finally, we would like to particularly encourage submission of MSP proposals for any ocean basin or marginal sea and *Chikyu* proposals where riser drilling technologies are required. Both of these latter categories of proposals would benefit from increased proposal pressure.

Overall we are excited by the quality of proposals being submitted to the IODP and by the system in place to evaluate them. You should always feel free to contact us with any questions. For those with proposals in the system, proposal watchdogs are a great resource, and for those planning proposals, please feel free to reach out to SEP members for guidance and suggestions. We look forward to reading new submissions and contemplating all the great science that can be done with a drill bit.

Sincerely,

Science Evaluation Panel Co-Chairs

Sean Gulick (Site) and Ken Miller (Science)

Unlocking the secrets of slow slip events with IODP drilling at the Hikurangi subduction zone, New Zealand

Laura Wallace, Demian Saffer, Philip Barnes, Ingo Pecher

One of the most exciting discoveries of the last decade in the field of seismology is the recognition that many faults undergo episodic, slow deformation events. These slow slip events (SSEs), together with other observations that document a continuous spectrum of fault slip behavior, have raised fundamental new questions about the mechanics of fault slip and earthquake generation. Slow slip events involve transient aseismic slip on a fault (lasting weeks to months) at a rate intermediate between plate boundary displacement rates and those required to generate seismic waves. Only since the advent of dense, plate boundary–scale geodetic networks in the last decade has the importance of SSEs as a significant mode of fault slip been recognized.

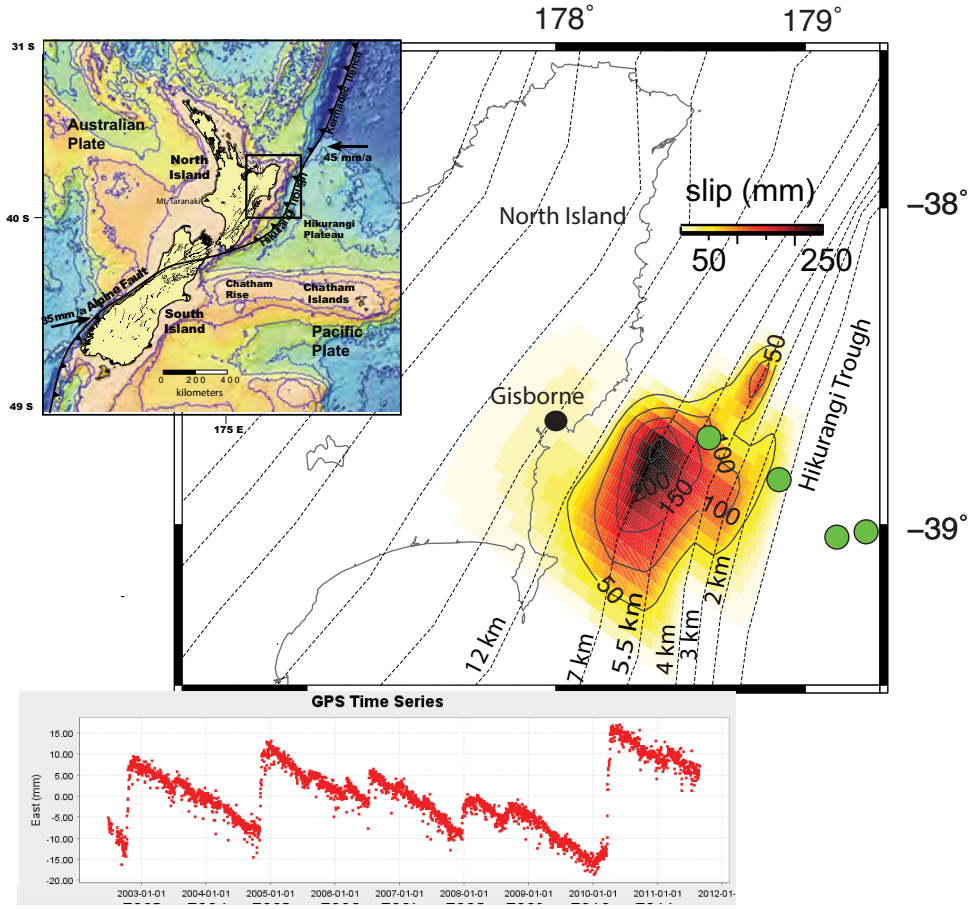

Figure 1: Tectonic setting (upper left inset) and location of Expedition 372/375 drilling transect and slow slip on the interface from seafloor geodetic studies (see color scale; Wallace et al., 2016) at northern Hikurangi. Green dots are planned primary drill sites for Expeditions 372 and 375. Lower left inset shows the east component of the position time series for a cGPS site near Gisborne to demonstrate the frequent repeatability of SSEs since they were first observed in 2002.

Recent studies suggest that at some subduction margins, shallow (<15 km deep) SSEs accommodate a significant fraction of plate convergence (30-100%), with important implications for understanding both shallow earthquake slip and tsunami hazards (Wallace et al., 2012, 2016; Araki et al., 2017). Yet, despite the now widespread observation of slow slip events at plate boundaries (and particularly at subduction zones), there are still major outstanding questions regarding the causes of slow slip events, the underlying mechanics, rock and fault properties, *in situ* conditions, and their relationship to earthquakes. IODP Expeditions 372 and 375 are planned offshore the North Island of New Zealand for late 2017 and early 2018, and will be the first ever scientific drilling expeditions specifically targeted at unlocking the secrets of slow slip events.

IODP Expeditions 372 and 375…will be the first ever scientific drilling expeditions specifically targeted at unlocking the secrets of slow slip events.

The northern Hikurangi subduction zone is the site of the shallowest well-documented slow slip events on Earth. Due to the close proximity of the slow slip source area to the seafloor here, it has become an important international target for a variety of investigations to understand the physical mechanisms that lead to slow slip. A recent geodetic study using Absolute Pressure Gauges deployed on the seafloor demonstrated for the first time that slow slip occurs to within as little as 2-3 km of the seafloor, and it is possible that it continues all the way to the trench (Wallace et al., 2016; Figure 1). This contrasts with many other slow slip regions such as Cascadia, Mexico, and Alaska, where well-studied slow slip events occur much deeper, at

greater than 25 km depth.

The frequent recurrence (1-2 years) and large magnitude of slow slip (Fig. 1), combined with the close proximity of the slow slip source region to the seafloor offshore New Zealand, offer an unparalleled opportunity to use scientific ocean drilling to answer some of the most fundamental questions regarding the origin of slow slip events through drilling, sampling, and monitoring. The two upcoming *JOIDES Resolution* expeditions aim to investigate the processes, fault properties, and *in situ* conditions that underlie subduction zone SSEs at northern Hikurangi, through a combination of coring and logging of the frontal thrust, upper plate, and incoming sedimentary succession (Figure 2) and installation of borehole observatories in the frontal thrust and upper plate above the slow slip source area. Logging While Drilling (LWD) data will be acquired on Expedition 372 (in conjunction with Ancillary Project Letter drilling to investigate submarine landslides; 26 November 2017–4 January 2018), while the coring objectives and installation of the borehole observatories will take place on Expedition 375 (8 March–5 May 2018).

Coring and logging results from Expeditions 372 and 375 will reveal the roles that fluids in the fault zone and rock frictional properties play in the occurrence of slow slip. These data will also improve our constraints on the thermal-metamorphic regime, stress state, fault architecture, and material properties in the crust surrounding the slow slip region. Long-term observatories installed in the frontal thrust and upper plate will record changes in pore pressure and temperature throughout several slow slip cycles, and monitor changes in fluid flow rates and fluid geochemistry within the fault zone. This will greatly improve our understanding of the temporal and spatial distribution of slow slip on the offshore plate boundary, and enable evaluation (for the first time) of the feedbacks between slow slip and the hydrogeology of the plate boundary zone.

The drilling results will be complemented by a suite of co-located geophysical investigations being undertaken as part of United States, New Zealand, Japanese, and UK-funded projects. These include a 3D seismic survey of the drilling transect (using the *R/V Marcus Langseth*) in January 2018, rolling deployments of seafloor geodetic instruments and Ocean Bottom Seismometers in the drilling transect over the next several years, and many other activities. IODP drilling is the centerpiece of these efforts, and together these studies will provide the most comprehensive and detailed datasets ever acquired to resolve the origin of episodic slow slip behavior.

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Saffer, D.M., Wallace, L.M., and Petronotis, K. (2017), *Expedition 375 Scientific Prospectus: Hikurangi Subduction Margin Coring and Observatories.* International Ocean Discovery Program. http://dx.doi.org/10.14379/iodp.sp.375.2017.

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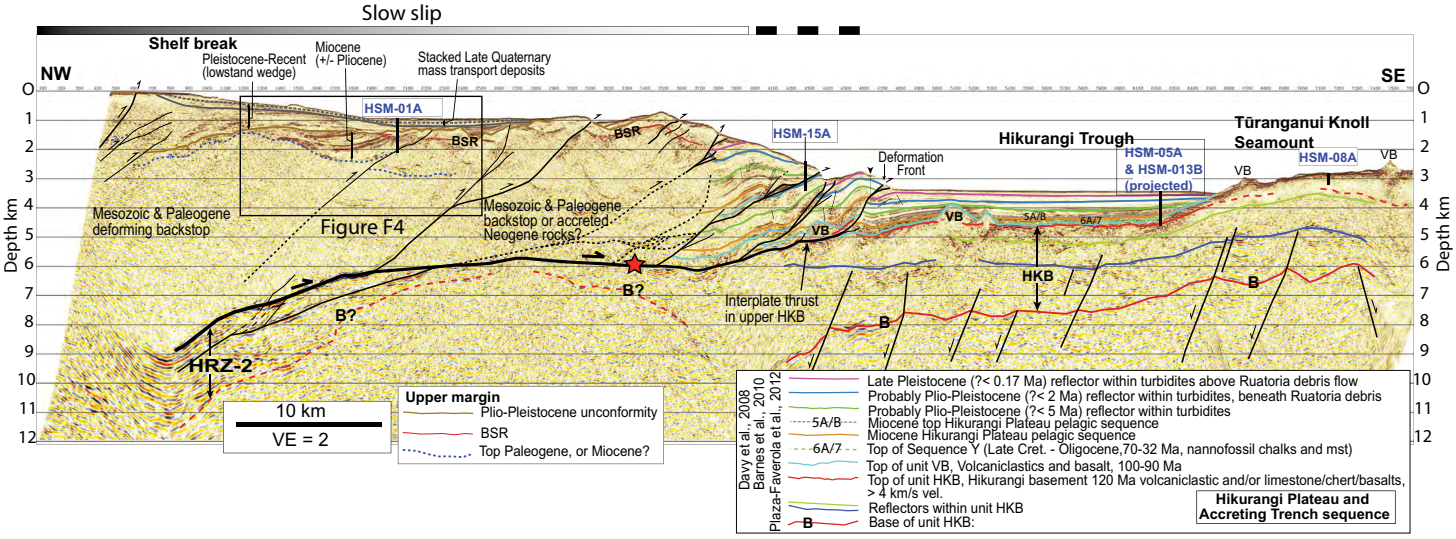


Figure 2: Depth converted seismic Profile 05CM-04 showing the locations and depths of several of the planned primary and alternate sites, as well as stratigraphic and structural interpretation. Red star shows projected location of a 1947 tsunami earthquake. Location of the seismic profile coincides with the drilling transect shown in Figure 1. (Figure reproduced from Saffer et al., 2017.)

Workshop Report: Developing IODP Drilling Strategies for Assessing Submarine Slide Stress State and Failure History

Matthew Hornbach, Derek Sawyer, Hugh Daigle, and Jenna Hill

Although the public often associates submarine landslides and tsunamis with active margins in the Pacific or Indian Oceans, marine scientists have long recognized slope failures on passive margins as potentially significant and sometimes deadly geohazards. For example, less than 90 years ago, the 1929 Grand Banks earthquake caused a slope failure in the Western North Atlantic that generated a deadly tsunami, inundating North American coasts. Even larger slide-generated tsunami waves struck Scotland less than 10,000 years ago when part of the Storegga slide, located offshore Norway, failed. If either of these events happened today along the U.S. Eastern Seaboard, it could potentially impact millions of people and cause billions of dollars in damage. But what is the likelihood of events such as these? How frequently do they occur? What typically triggers them? And, perhaps most importantly, what areas are at highest risk of failure?

To address these questions more fully, the IODP workshop "Drilling strategies for assessing links between Quaternary Gulf Stream dynamics, pore pressure evolution, and slope stability on the Western North Atlantic Margin" was held on April 11-13, 2017, at Southern Methodist University in Dallas, Texas. The goal of this workshop was to bring together a multidisciplinary community of scientists to develop new ocean drilling proposals to elucidate *in situ* stress state and associated factors influencing slope stability on passive margins. Recently acquired seismic data collected off the U.S. east coast (2014-2015) as part of the GeoPRISMS Eastern North American Margin (ENAM) Community Seismic Experiment and other USGS projects combined with preliminary modeling results have raised important new questions regarding the dynamics and evolution of slopes and continental margins and the cause, style, and consequences of slope failure along the margin. As a result, the IODP Science Evaluation Panel (SEP) strongly encouraged a workshop to expand on these questions and those raised by initial reviews of IODP Proposal 811-Full ("The impact of recent temperature warming and pore pressure rebound on slope stability") to assess how ocean drilling in the western North Atlantic might ad-

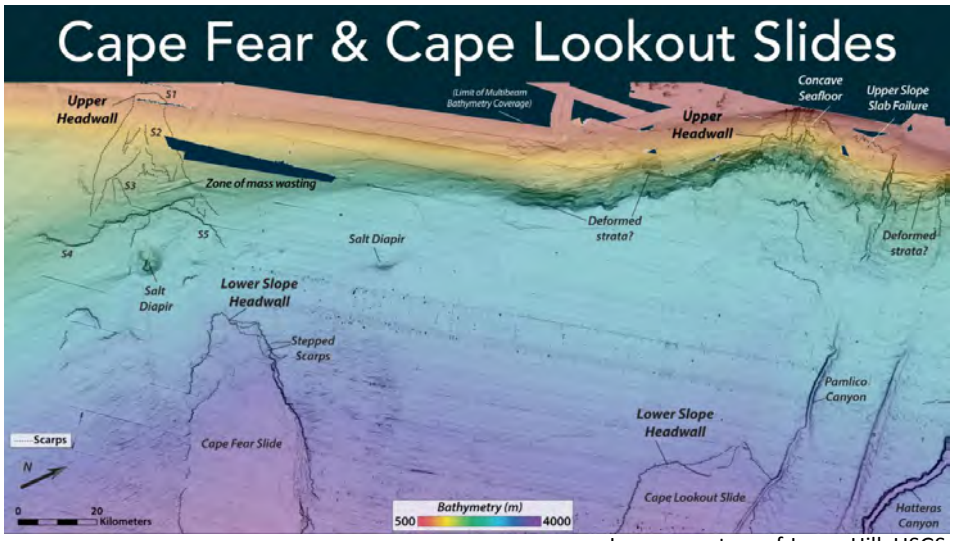


Image courtesy of Jenna Hill, USGS.

dress key questions related to sediment transport, margin stress state, and slope stability. Since the *JOIDES Resolution* will be operating in the Atlantic Ocean by mid-to-late 2019, it was important to hold the workshop as soon as feasible to ensure pertinent, high-quality proposals could be developed and make their way through the IODP proposal review process before the ship reaches potential drill sites.

The Dallas workshop was a resounding success. A total of 36 scientists—more than 50% early career—attended, exchanged ideas, posed questions, and developed paths forward for generating quality IODP drilling proposals that assess slope stability and failure history on the western North Atlantic Margin. After three days of presentations, break-out group interaction, and frank discussion, the group reached a clear consensus that at least two proposals should be developed. This was in part due to the reality that to complete all desired objectives would likely take more than 100 days at sea, well beyond the length of a typical, single IODP expedition. From the workshop, two distinct yet complementary proposal ideas emerged. The first proposal, informally recognized as "the slide source proposal," consists of testing hypotheses associated with the pre-failure stress state where both retrogressive and non-retrogressive slope failure occur. Specifically, the slide source proposal will constrain the current stress-state above and below passive margin headwalls, where repeat failure occurs, and test which factors most critically influence slope failure on the upper margin. Hypotheses include pore pressure rebound, sedimentation rate vs. pressure, and ocean temperature change and associated methane hydrate dissociation. The second proposal, informally recognized as "the slide sink proposal," will assess properties of post failure sediments, whether continuous failure occurs today via creep, and the timing of past slide events that might be used to constrain hazard.

Since the workshop concluded in April 2017 at least two pre-proposals have been submitted, to study slope failures on the passive western North Atlantic Margin, both led by early-career scientists. Derek Sawyer (Ohio State University) is the lead proponent of a pre-proposal (930-Pre) that will quantify the physical stress state near passive margin submarine slide headwalls. Hugh Daigle (University of Texas, Austin) is the lead proponent of a pre-proposal (922-Pre) that will constrain the frequency, size, and mechanical properties of Cenozoic slide deposits by drilling into seismically imaged slope failure complexes. The proponents urge any scientists interested in becoming involved in either of these studies to contact them, as they hope to receive encouraging reviews from SEP and develop full proposals to submit in Spring 2018.

More information on this workshop can be found in the final workshop report, published online at http://usoceandiscovery.org/workshop-slope-stability/.

2018-19 Ocean Discovery Lecture Series

For over twenty years, the Ocean Discovery Lecture Series (formerly the Distinguished Lecture Series) has brought the exciting results and discoveries of scientific ocean drilling to academic research institutions and informal learning centers. The roster of 2018-19 Ocean Discovery Lecturers will focus on topics such as climate change, monsoon history, sediment diogenesis, and more.

Sarah Feakins
University of Southern California
Climate change and ecosystem transformation: plant wax evidence from Indian Ocean drilling

Julia Reece
Texas A&M University
Mud and Bugs Under Stress: Compression of Marine Sediments Beneath the Seafloor

Liviu Giosan
Woods Hole Oceanographic Institution
Drilling the Monsoon: From Mountain Building to the Fate of Civilizations

Brian Romans
Virginia Tech
Reconstructing deep ocean circulation during Cenozoic climate transitions from the marine sediment record

Sidney Hemming
Lamont-Doherty Earth Observatory
Toward a 5 million year record of the greater Agulhas current system

Evan Solomon
University of Washington
Revisiting the role of continental margin sediment diagenesis in marine geochemical cycles

School of Rock - 2017

"Welcome aboard the JOIDES Resolution. We hope this experience will blow your mind."

by Stephanie Milam-Edwards

SUBIC BAY, PHILIPPINES - On July 10, 2017, I, along with a cohort of 15 other educators, graduate students and young scientists from the US, Australia, and Brazil sailed from Subic Bay, Philippines on a 2.5 week transit to Townsville, Australia as part of the School of Rock - 2017. These transit expeditions (over the course of several years) have utilized the down time of the *JOIDES Resolution* when it has been tied up or is preparing for a new expedition—in this case, IODP Expedition 371. The United States Science Support Program (USSSP) uses these opportunities to educate teachers and students about the program, the ship, and its unending quest to conduct science to unlock Earth's secrets. The primary goal of this School of Rock was to partner secondary level educators with early career scientists in such a way as to strengthen the pipeline of students entering STEM/geoscience fields and increase diversity, especially in traditionally under-represented groups.

Over the course of the transit, professors Mark Leckie (UMass-Amherst), Jon Lewis (IUP), Lisa White (UCMP), Steve Hovan (IUP) and Education and Outreach Manager Sharon Cooper (USSSP) conducted classes to deepen our understanding of geology, microfossils, sedimentology, oceanography, meteorology and climate change. We learned about the IODP program past, present, and future. We were welcomed as guests, meeting and interacting with the drilling/technical crew that supports the science conducted on the *JOIDES Resolution* and those crew members working behind the scenes to ensure science happens safely and effectively.

Our instructors said the goal was to "blow our minds." To say it was an awesome experience doesn't do the program justice. My mind was blown many, many times. I recall the first time sitting in the conference room and registering that all the books on the shelves behind me represented expeditions dating back to the 60's, a hundred plus volumes representing 130 people that had come aboard for 2 months of their lives in pursuit of understanding Earth's history; in support of STEM education before it was even labeled that. I knew that the curriculum I teach to my students each year as a secondary level Earth Science teacher came from drilling programs past and present, but the scope of the operation and all the people who have devoted their time over the years to build the body of knowledge that explains Earth's inner workings was staggering. Both my bachelor's degree in oceanography and my employment as a science teacher were made possible by this program, this ship, and vessels like her.

I came away with a deeper understanding of scientific principles and concepts, how science is conducted in real time, and the need to promote the *JOIDES Resolution* and this program to every student I can, young and old alike, majority and minority. Aboard, our small group was able to make meaningful connections with college professors and graduate students. We developed workable plans to increase diversity, to generate excitement and interest in STEM fields in our respective areas of the globe.

I feel I can speak for all of us 2017 "rockers" when I say, mission accomplished… MIND BLOWN!

Workshop Report: Land-Ocean Interactions across the Indian Ocean, Toward Regional Integration of Recent Drilling Results

Rebecca S. Robinson, Peter Clift, and Liviu Giosan

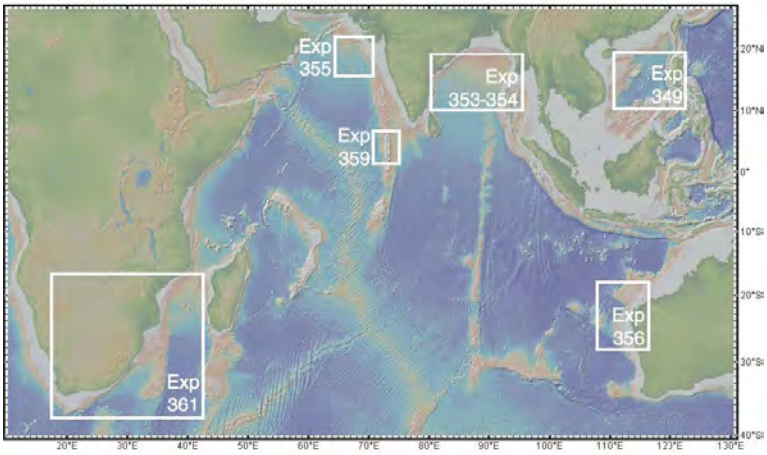
The Indian Ocean seafloor hosts potential sedimentary records of tectonic, biogeochemical, atmospheric, and oceanographic processes that likely played a major role in regulating regional and global climate during the Cenozoic. Between 2013 and 2016, IODP conducted a regionally focused drilling initiative of seven expeditions with a broad emphasis on understanding the evolution of the Asian monsoon—IODP Expeditions 346 (Sea of Japan, East China Sea), 353 (Bay of Bengal, Andaman Sea), 354 (Bengal Fan), 355 (Indus Fan), 356 (Northwestern Australian continental margin), and 359 (Maldives Inner Sea)—and more specific goals including reconstructing sea level (Expedition 359), African hydroclimate (Expedition 361), and examining variation in ocean circulation and exchange of waters between the Pacific, Indian, and Atlantic Oceans (Expeditions 356 and 361). This workshop brought individual expedition participants together to share their results with other Indian Ocean investigators and to foster collaboration and synthesis of the regional drilling campaign.

The workshop was held at the University of Rhode Island's Graduate School of Oceanography in Narragansett, RI on July 10-12, 2017. The 43 U.S. and international participants came together with three primary goals: (1) to review results of the recent regionally-focused scientific drilling expeditions in the Indian Ocean; (2) to propose possible paths for an integrated understanding of the role and response of climate in regulating Indian Ocean hydrology, hydrography, sedimentation, and biogeochemistry; and (3) to synthesize practical lessons for future scheduled and proposed regional IODP drilling campaigns.

The workshop included both the sharing of results from recent drilling expeditions, and several large and small group discussion sessions. Discussion outcomes included specific recommendations related to the optimization of regional drilling campaigns and the synthesis of regionally and globally significant results. Potential future drilling targets within the region were also identified.

A great deal of excitement was generated by the preview of new scientific results from around the Indian Ocean region. It is evident from the preliminary results that the community will make great strides toward addressing the Climate and Oceans challenges in the 2013-2023 International Ocean Discovery Program Science Plan, with a broad emphasis on **Challenge 3** ***(What controls regional patterns of precipitation, such as those associated with monsoons or El Niño?)***, especially during the Late Miocene to Recent. Materials recovered are well suited for generating proxy records of atmospheric carbon dioxide, sea surface temperature, and ocean circulation changes during the warm Pliocene, and potentially the Miocene, that address **Challenge 1** ***(How does Earth's climate system respond to elevated levels of atmospheric CO_2?)***; sea level records that address **Challenge 2** ***(How do ice sheets and sea level respond to a warming climate?)***; and histories of ocean chemical change that address **Challenge 4** ***(How resilient is the ocean to chemical perturbation?).***

The Indian Ocean was the first basin targeted by the newly implemented IODP regional drilling strategy. Workshop participants debated ideas on the optimal design of future regionally-dedicated drilling campaigns. Recommendations for maximizing efficacy during regional planning included the development of pre-expedition workshops to generate interest, build a community, and stimulate proposal preparation. In particular, such workshops are viewed as opportunities to create proponent teams that



Map of seven IODP expeditions that were part of the Indian Ocean regional drilling campaign between 2013 and 2016.

are balanced in terms of career stage and discipline, thus ensuring diverse community involvement in every stage of IODP drilling, from planning to final scientific syntheses. Drilling in the Indian Ocean has several challenges associated with the planning phase, including obtaining permissions from countries in whose Exclusive Economic Zones drilling is planned. Operational challenges were also encountered in the Indian Ocean region, including drilling in difficult-to-recover lithologies such as sands. Discussions of how these planning and operational challenges might be addressed in future campaigns focused on sharing knowledge related to these types of hurdles between co-chiefs and other key scientific personnel, especially those that arise mid-campaign, to ensure effective communication of potential issues and tested solutions.

Post-expedition recommendations to enhance the scientific results included convening synthesis workshops, such as this one, to discuss materials recovered, unanticipated results, proposed goals, and on-going science. Workshops could include proxy development and analytical protocol discussions to ensure maximal data compatibility across expeditions. Ultimately, broad community support for further synthesis of regional drilling results was apparent. Potential funding sources for post-expedition workshops and appropriate resulting products will be topics of on-going discussion. Finally, the group brainstormed future drilling targets that would address scientific questions left unanswered by the current campaign, in anticipation of the ship returning to the Indian Ocean post-2022.

More information on this workshop can be found in the final workshop report, published online at http://usoceandiscovery.org/workshop-indian-ocean-regional-synthesis/.

Thoughts and Advice on Applying to Sail

by Carl Brenner, Director, U.S. Science Support Program

When Lamont-Doherty assumed management of the U.S. Science Support Program (USSSP) in early 2015, one of our main goals was to make the IODP expedition staffing process as transparent as possible. As we approach our fourth year of management, we would like to provide some statistics on U.S. shipboard participation in IODP over the past three years, as well as advice for those aspiring to sail.

The process of shipboard staffing is explained on the "Apply to Sail" page of the USSSP website (http://usoceandiscovery.org/expeditions/). It begins when one of the three ship operators—the *JOIDES Resolution* Science Operator (JRSO); the ECORD Science Operator (ESO, the operator of mission-specific platforms); or Japan's Center for Deep Earth Exploration (CDEX, the operator of *Chikyu*)—issues a Call for Applications. Candidates from each IODP nation or consortium apply to their individual Program Member Office (PMO); those in the U.S. apply to USSSP. U.S. applications are reviewed by the Staffing Subcommittee of the U.S. Advisory Committee for Scientific Ocean Drilling (USAC), currently chaired by Marta Torres, which weighs a number of factors in its evaluations, including the expertise needed to achieve the expedition's scientific objectives, the strength of each applicant's proposed postcruise research plan, and the importance of ensuring diversity of career level, institution, and gender in the U.S. science party. After considerable consultation with USAC, USSSP assembles and reviews the rankings and comments and forwards them to the relevant operator. Finally, the operator works with the expedition co-chiefs and expedition project manager to balance expertise, national quotas, and diversity before issuing invitations to sail. Invitations are sometimes issued iteratively—that is, some are issued later and are conditional upon the responses to previous ones. The overall process is represented graphically at http://bit.ly/2zOqvjs.

This is a complex process, with a lot of moving parts that can seem opaque to applicants. At various times it has been suggested that either USAC, the operators, or the co-chiefs may have a disproportionate influence on the selection process. In truth, the process is collaborative and works remarkably well, with excellent communication amongst all of the parties involved. This is a tribute to all three operators, which are extraordinarily cooperative with USSSP and which labor to assemble the best possible science party to address expedition objectives while also providing the proper mix of senior and early career scientists, including students. This allows younger participants to benefit from mentoring by senior scientists, while also assuring the development of the next generation of IODP leaders.

USSSP and USAC feel strongly that a successful shipboard staffing program must provide opportunities for U.S. scientists at all career levels. To this end, our office

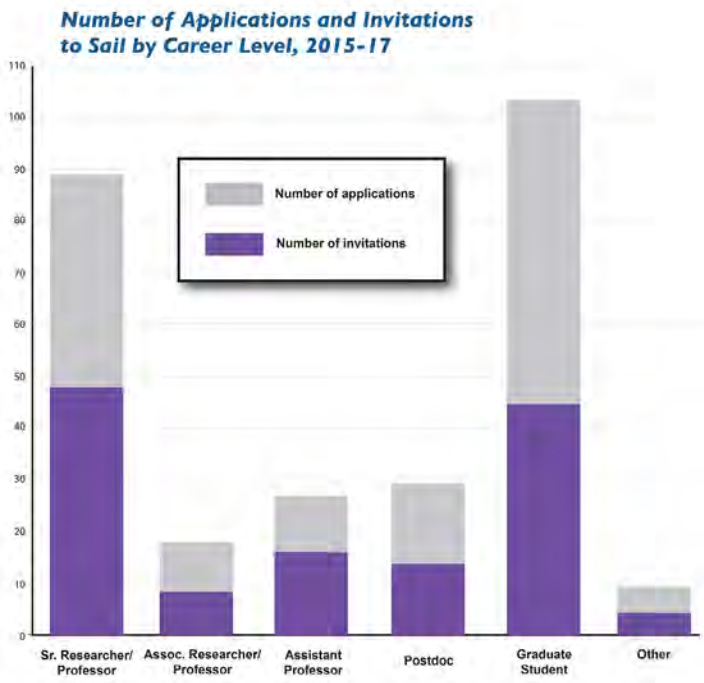
has tracked in detail both the number of applications received from, and the number of invitations issued to, U.S. applicants at all career levels since we assumed management of USSSP. Graduate students comprise the largest percentage of the overall applicant pool (over 37% of all applications). Next are senior researchers/professors (about 32%), followed by postdocs (11%), assistant professors (10%) and associate researchers/professors (7%). A few scientists fall outside of these categories (e.g., emeritus researchers) and make up the remainder of the applicants.

As indicated in the accompanying table and figure, assistant professors are invited at the highest rate (59%), though their overall numbers are small, while senior researchers are invited at a rate of about 54%. "Early career" researchers (defined as assistant professors and postdocs) are invited at a rate of slightly over 50%, indicating that this population, despite many challenges that may suppress applicant numbers (e.g., teaching obligations, uncertainty about future academic affiliation, and the need to prepare for the tenure process), is being afforded career-building opportunities to sail. Finally, graduate students are invited to sail at a very respectable rate of almost 43%, and have comprised over 30% of all U.S. science party berths filled during our management period. The takeaway message here is that scientists at all career levels, including graduate students, have a very reasonable chance of sailing, provided they submit competitive, high-quality applications.

Excluding co-chief scientists, who are not reviewed by USAC, the gender balance of all U.S. science parties staffed on our watch has been 56% male and 44% female. This compares very favorably to the longer-term balance over the life of IODP, which is closer to 2:1 male. (Interestingly, the aggregate U.S applicant pool also breaks out as 56% male and 44% female, indicating an identical acceptance rate.)

What makes an application to sail competitive? First, your participation plan should address how you will contribute to specific expedition objectives. Make sure you read the expedition summary on the operator's expedition web page; you may also wish to read the IODP proposal(s) on which the expedition is based. Your participation plan should be clear, focused, written for a non-specialist Earth science audience, and have goals that are achievable within the one year moratorium. Avoid dwelling on past accomplishments; these can be gleaned from your CV.

Career Level	# of Applications	# of Invitations	Invitation Rate
Sr. Researcher/Professor	89	48	53.9%
Assoc. Researcher/Professor	18	8	44.4%
Assistant Professor	27	16	59.3%
Postdoctoral Researcher	29	13	44.8%
Graduate Student	103	44	42.7%
Other	9	4	44.4%
Total:	275	133	48.4%



Second, graduate students and postdocs should provide as much information as possible concerning their likely affiliation at the time of the expedition and during the expedition moratorium period. It is important to demonstrate that you will have access to a laboratory for your proposed post-cruise research, as well as an institutional affiliation through which your salary and postcruise support can be routed. We recognize these may be uncertain at the time you apply, but let us know the paths you are pursuing. Graduate students are encouraged to ask their advisors to include such information in their letters of recommendation.

Finally, applicants should take advantage of expedition webinars, usually held around two weeks before the application deadline. These are an invaluable source of expedition-specific information, and will also allow you to engage directly with at least one co-chief scientist and the expedition project manager, as well as with USSSP personnel. Both the expedition objectives and application process are addressed in detail during these webinars, which are announced in the USSSP Community Update emails and on the expedition-related pages on the USSSP website. If you are unable to attend a webinar, you can watch a recording of it after the fact. The webinars are well worth your time, especially for younger applicants and those less familiar with the program.

Sailing on an IODP expedition can be a life-changing experience. If you are considering applying to sail, I hope you find the information in this letter both illuminating and encouraging. Please feel free to contact a USAC member or USSSP if you have remaining questions about the staffing process.

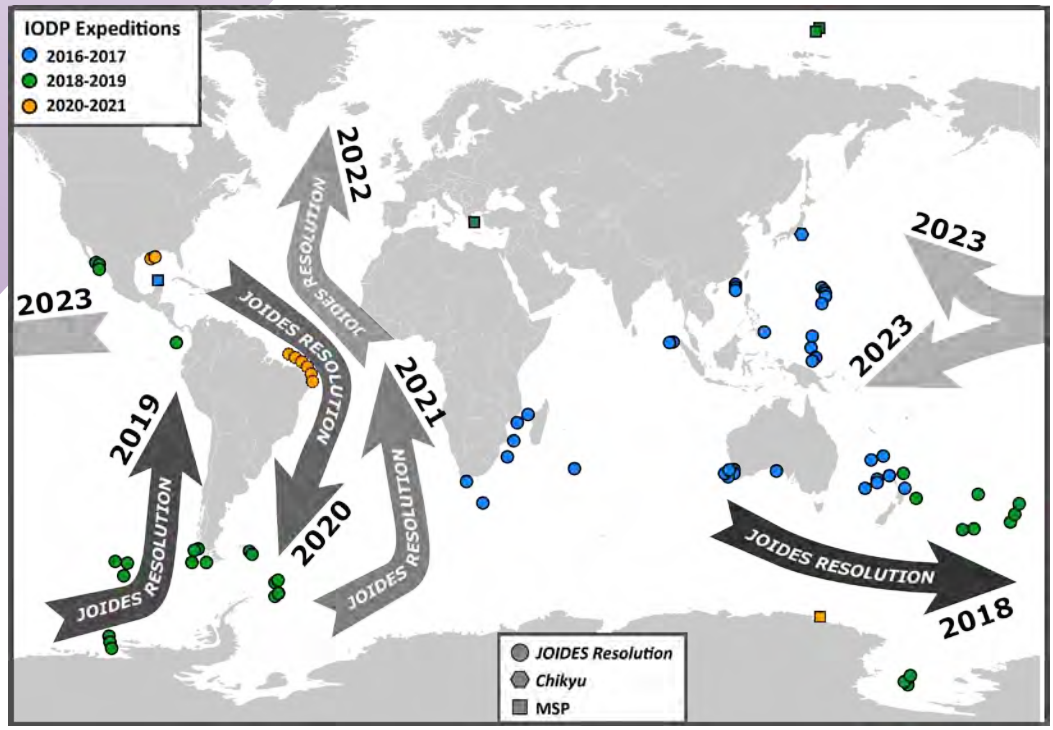
Good luck!

2017 - 2020 IODP EXPEDITION SCHEDULE

Platform	#	Expedition	Dates	Ports
	372	Creeping Gas Hydrate Slides and Hikurangi LWD	11/26/17 - 01/04/18	Fremantle, Australia - Lyttelton, New Zealand
	374	Ross Sea West Antarctic Ice Sheet History	01/04/18 - 03/08/18	Lyttelton, New Zealand - Lyttelton, New Zealand
	380	NanTroSEIZE Stage 3: Frontal Thrust Long-Term Borehole Monitoring System (LTBMS)	01/12/18 - 02/24/18	Shimizu, Japan - Shimizu, Japan
	375	Hikurangi Subduction Margin	03/08/18 - 05/05/18	Lyttelton, New Zealand - Auckland, New Zealand
	376	Brothers Arc Flux	05/05/18 - 07/05/18	Auckland, New Zealand - Auckland, New Zealand
	358	NanTroSEIZE: Plate Boundary Deep Riser 4	10/7/18 - 3/21/19	TBD
	378	South Pacific Paleogene Climate	10/14/18 - 12/14/18	Lyttelton, New Zealand - Papeete, Tahiti
	379	Amundsen Sea West Antarctic Ice Sheet History	01/18/19 - 03/20/19	Punta Arenas, Chile - Punta Arenas, Chile
	382	Iceberg Alley Paleoceanography & South Falkland Slope Drift	03/20/19 - 05/20/19	Punta Arenas, Chile - Punta Arenas, Chile
	383	Dynamics of Pacific Antarctic Circumpolar Current	05/19 - 07/19	TBD
	384	Panama Basin Crustal Architecture (504B) & Engineering Testing	07/19 - 09/19	TBD
	385	Guaymas Basin Tectonics and Biosphere	09/19 - 11/19	TBD
	386	Gulf of Mexico Methane Hydrate	01/20 - 03/20	TBD

JOIDES Resolution
Chikyu

JOIDES Resolution Ship Track: Summer 2017 and beyond



Map modified with permission from the IODP-JRFB