Summer 2019

Ocean Discovery

The U.S. Scientific Ocean Drilling Community Newsletter

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CALENDAR

July

8-10 — **U.S. Advisory Committee for Scientifi Ocean Drilling**
New York, NY

10-26 — **ECORD Urbino Summer School in Paleoclimatology**
Urbino, Italy

23-24 — **Science Plan Development Working Group**
New York, NY

September

4-5 — **Environmental Protection and Safety Panel**
College Station, TX

8-18 — **School of Rock 2019: Show Me the Evidence**
San Diego, CA

11-14 — **IODP Forum and PMO Meeting**
Osaka, Japan

16-27 — **Bremen ECORD Summer School**
Bremen, Germany

December

11 — **IODP AGU Town Hall**
San Francisco, CA

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 Institute for Marine-Earth Exploration and Engineering (MarE^3), 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.

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

Letter from the JRFB Chair

Dear Colleagues,

The sixth meeting of the *JOIDES Resolution* Facility Board (JRFB) immediately followed the NEXT workshop on 8-9 May 2019 in Denver, CO. This meeting covered the usual reports from the other facility boards and review panels, scheduling of proposals forwarded to the JRFB over the last year, replacement of the *JOIDES Resolution*, and looking to the next scientific ocean drilling program post-2023.

The meeting produced 16 consensus statements and 9 action items. A summary of the most pertinent consensus statements is given here:

- The submission of a record number of drilling proposals at the 1 April 2019 deadline demonstrates the importance of scientific ocean drilling to the international science community and represents a statement that the program is strong in terms of community support.

- The National Science Board renewed funding for the *JOIDES Resolution* through 2024, which led the JRFB to commit to scheduling proposals through FY 2024, rather than the end of 2023 when the current science plan ends.

- The ship track continues to create proposal pressure in the areas we anticipate the JR will move beyond FY 2021. We scheduled one proposal, 910-Full2 (Continental Margin Methane Cycling) for October-November, 2021. This proposal was one of two forwarded to the JRFB from SEP over the last year and represents the first scheduled expedition for FY 2022. It is important that the community understand that the JRFB is now looking into the Pacific and Indian oceans for future proposals, and as we approach renewal increased proposal pressure will be critical in securing funding for the next phase of scientific ocean drilling.

- The excitement throughout the ocean drilling partners for renewal of the program beyond 2023 has been gratifying to witness. The energy and passion for the program has been a privilege to experience in the different planning workshops I have attended. Perhaps what is most exciting is the number of early career people involved in these workshops who are not afraid to speak up! They will be implementing the next phase of the program and it is very encouraging to know that the program is in good hands. In particular, the presentation by Anthony Koppers at the JRFB, summarizing the results from the NEXT workshop, was well received, especially the emphasis on interdisciplinary research. The three main topics and the cross-cutting issues resonated well with the JRFB meeting attendees.

- The JRFB also supports the *JOIDES Resolution* Science Operator in its efforts to find a replacement for the aging workhorse of the program, the *JOIDES Resolution*. Through dialogue with NSF, options are being explored for replacing the JR beyond 2023. However, a new science plan and a new name for both the program and the science plan will be needed soon. Hence the IODP Forum Chair, Dick Kroon, is moving ahead with an aggressive timetable to have at least a near-final draft of the new science plan by June 2020. This is an exciting time for our community!

In closing, I would like to thank you for your continued support of scientific ocean drilling in the United States. We will need to be more proactive than we have in the past, so I will probably be calling on you in the near future to support increasing the recognition of the program we all love and support. Also, please continue to submit proposals to the program—we need proposal pressure to support renewal and our contention that this is an important international scientific collaboration.

All the very best,

Clive R. Neal
Chair, *JOIDES Resolution* Facility Board

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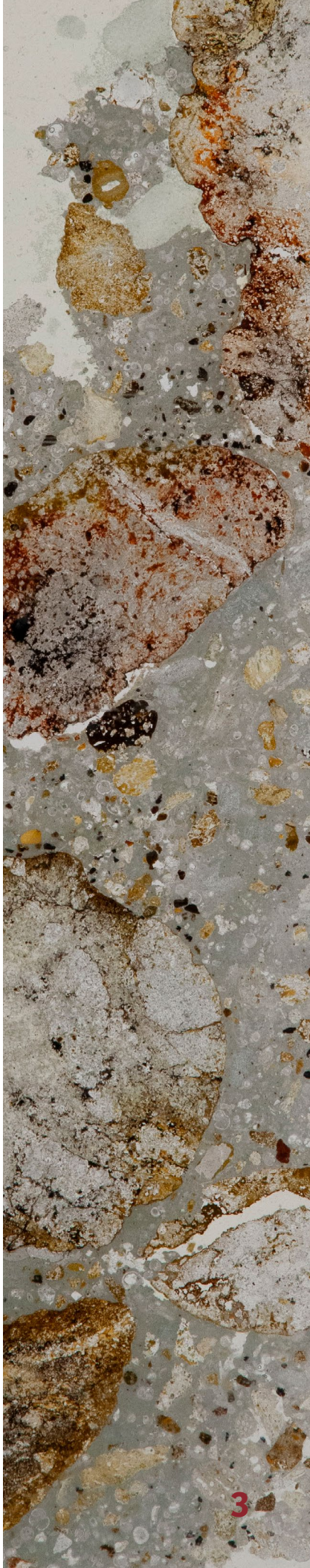

IODP Expedition 385: Guaymas Basin Tectonics and Biosphere

Andreas Teske and Daniel Lizarralde, Expedition 385 Co-Chief Scientists

Figure 1. In the hydrothermally active spreading center of Guaymas Basin, Riftia tube worms and microbial mats (white and yellow) thrive in a chemosynthetic seafloor ecosystem above hot, sediment-hosted igneous sills. Photo from Alvin submersible dive 4868, Dec. 19, 2016, Expedition AT37-06, courtesy of WHOI.

The time scales of tectonic plate motions and life cycles in the biosphere are vastly different, but these systems are nevertheless linked. Moreover, how these systems interact and control the cycling of elements, and particularly carbon, seem to be key to the habitability of planets (e.g. Korenaga, 2012; Dohm and Maruyama, 2015; Foley and Smye, 2018). IODP Expedition 385 offers the opportunity to investigate poorly understood aspects of this interplay in Guaymas Basin, in the Gulf of California, where seafloor-spreading magmatism in this young ocean basin occurs in the presence of rapid, organic-rich sediment deposition from highly productive overlying waters, creating a spectrum of hydrothermalism where tightly linked physical, chemical, and biological processes regulate the cycling of sedimentary carbon. Shallow magmatism in Guaymas Basin occurs as igneous sill intrusion into sediments, and the hot intruded sills alter the surrounding sediments, releasing carbon and driving hydrothermal flow, moving carbon-rich fluids towards the seafloor (Einsele et al., 1980). The active regions at the spreading center harbor spectacular vent fauna, microbiology, and hydrothermal edifices (Figure 1, image above).

However, hydrothermal activity is not confined to the spreading center; active magmatic intrusion into sediments and focused hydrothermalism occur to more than 40 km off axis (Lizarralde et al., 2011; Berndt et al., 2016), subjecting a large volume of organic-rich sediments to thermal alteration and associated carbon release. Hydrothermal alteration to hydrocarbon and subsequent mobilization (Peter et al., 1991) re-injects buried carbon into the hydrosphere and potentially the atmosphere. These processes are believed to be linked to major shifts in global climate and mass-extinction events throughout Earth history (e.g., Svensen et al., 2004; 2007; Aarnes et al., 2010). Subsurface microbes can intercept these hydrothermally generated and mobilized carbon compounds, especially hydrocarbons and methane; oxidize and remineralize them; or assimilate them into the biosphere (Teske et al., 2014). Guaymas Basin thus provides an ideal setting to study the linked tectonic, geochemical ,and microbial processes that govern carbon cycling in magmatic environments.

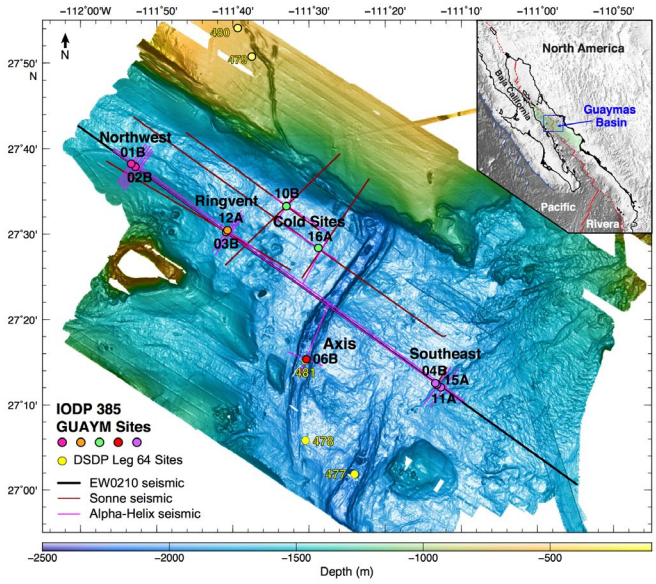

Figure 2. Bathymetry of Guaymas Basin with Baja California in the southwest and the Sonora Margin in the northeast. Proposed drilling sites (circles) and existing seismic transects (solid black and purple lines) are indicated. Inset shows the tectonic setting of the Gulf of California, Guaymas Basin, indicated in green shading, with the area of the main site figure indicated by a blue box. IODP = International Ocean Discovery Program, DSDP = Deep Sea Drilling Project.

Expedition 385 will drill through sediment/sill sequences in settings that span a range of sill-cooling ages, intrusion history and sediment type in order to better understand the physical, chemical and biological processes that control elemental cycling, including microbial carbon utilization and sequestration, in sill-driven sedimentary hydrothermal systems. Adjacent drill Sites 01 and 02, ~50 km northwest of the Guaymas Basin northern trough (Figures 2 and 3), provide a direct comparison between sediments that are undisturbed by sill intrusion and the same sequence of sediments altered by a ~100 k.y. old sill. Sites 03 and 12 will drill through sediments and a hot sill at an actively venting site,

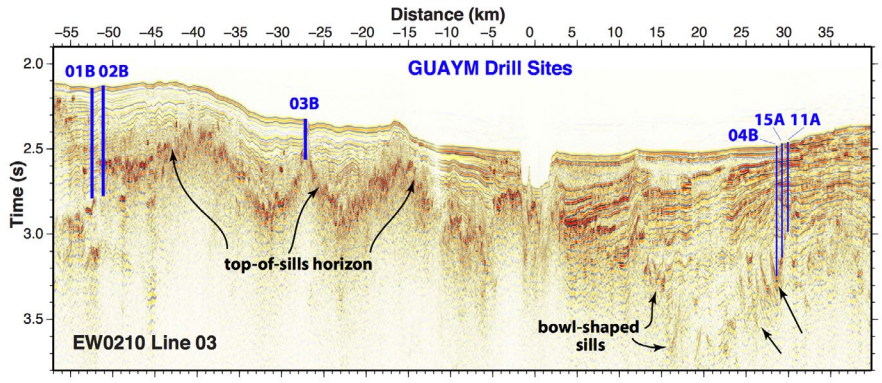

Figure 3. Migrated stack of seismic data from *Maurice Ewing* EW0210 Transect 3, along which proposed GUAYM Sites 01B, 02B, 03B, 04B, 11A, and 15A are located. This transect is coincident with Alpha Helix AH1605 Line 01-02.

while three sites southeast of the plate boundary (Sites 04, 11 and 15) illustrate the influence of terrigenous sediments on alteration products. Site 06, within the northern trough, will constrain the influence of tectonism on hydrothermal processes and alteration. Finally, Sites 10 and 16, close to the Sonora Margin and still active as cold-seeps, will study systems driven by deeply buried sills.

Scientific drilling in Guaymas Basin has a deep history. In December 1978 and January 1979, Deep Sea Drilling Project (DSDP) Leg 64 drilled three sites within the northern and southern troughs of Guaymas Basin (Curray et al., 1979; 1982). The discoveries and results of DSDP Leg 64 remain the foundation of our current knowledge of Guaymas Basin and early-stage seafloor spreading, especially the processes driven by magmatic intrusion into sediments and their consequences for deep geochemistry and carbon cycling. Building on this foundation, IODP Expedition 385 will investigate the fate of carbon deposited in Guaymas Basin, with relevance for the entire Gulf of California and, more broadly, similar marginal seas throughout the world. The expedition aims to understand the relative efficiencies of interacting microbial and chemical processes, some working to sequester carbon and others working to release carbon back to the ocean and the atmosphere, along with how those processes are influenced by factors such as sediment type, sill thickness, faulting and sill-intrusion depth.

By taking full advantage of modern drilling tools and sample recovery techniques (e.g., the advanced piston corer system) that have improved tremendously since DSDP Leg 64, undisturbed sediment samples will be recovered and ready for chemical and microbial analyses. We are excited and humbled by the exceptionally wide range of disciplines spanned by this IODP expedition, which has drawn a diverse group of participants already collaborating seamlessly to target scientific questions that range from mantle to microbes.

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Education and Outreach Activities

Milstein Science Series

On February 17, 2019, the U.S. Science Support Program (USSSP) participated in the Milstein Science Series: The Layers of the Ocean event at the American Museum of Natural History. This family-friendly festival includes exploration stations, panel discussions from experts in the field, and performances for younger audiences. The *In Search of Earth's Secrets* exhibit inflatable ship was a centerpiece for roughly 8,000 visitors.

Selected Conferences

STEM for All Showcase The 2019 NSF STEM for All Video Showcase: Innovations in STEM Education, was held online May 13-20, 2019. The event featured videos highlighting strategies to broaden participation and increase access for all, research informing Science, Math, Engineering, and Mathematics (STEM) and Computer Science (CS) teaching and learning, challenges and strategies in the implementation of STEM and CS programs, measuring impact of innovative programs, and partnerships fostering innovation. The STEM for All Video Showcase is an annual online event. Each year, it hosts between 100-200 3-minute video presentations from federally funded projects that aim to improve STEM and computer science education. During the 7 days of this online event, principal investigators, practitioners, administrators, researchers, policy makers, industry representatives, and the public at large are encouraged to participate. All participants are able to view the video presentations, post to the facilitated discussions related to each video, and vote for the videos that are most effective in conveying the creative work being done. All videos and discussions will be archived for future access thereafter.

NSF Facilities Meeting USSSP Education/Outreach staff were invited to participate the NSF Large Facilities Workshop in Austin, Texas. This was the first time that education and public outreach were a major topic at this annual meeting. More than 200 people attended, many of whom were education and public outreach staff from the variety of NSF Large Facilities around the country. This session led to numerous discussions about collaboration across facilities and with NSF to increase NSF and facility branding, leverage the work that each facility is doing independently, and build new synergistic projects and efforts. More information about the meeting can be found at https://www.largefacilitiesworkshop.com/19workshop/.

Plans are underway for the first JR Academy, a pair of undergraduate courses to be taught onboard the *JOIDES Resolution* during IODP Expedition 385T this summer. Approximately 12 undergraduates from across the country will be selected to sail with 2 instructors and 3 Outreach Officers. They will receive 10 course credits and work with their instructors and the small science party onboard to learn about introductory geology, oceanography, science communication, and much more.

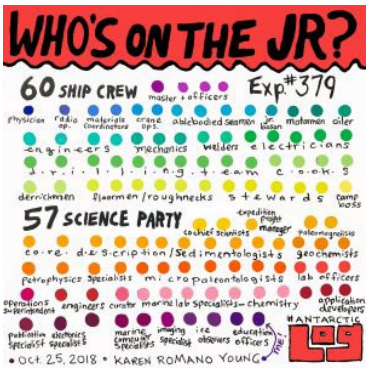
Plans are also underway for some exciting events at the first mainland U.S. JR port calls in a decade, both in San Diego. One is in mid-September and the other in mid-November. A School of Rock, a science symposium, school and public tours, smaller one-day educator workshops, and other events are in the works.

Milstein Science Series, American Museum of Natural History

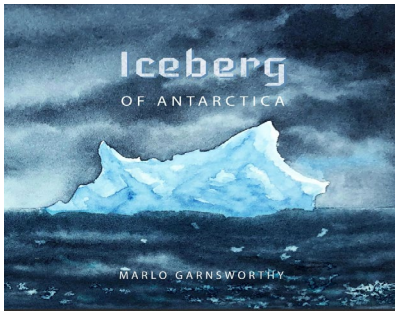
Expedition 379: Amundsen Sea West Antarctic Ice Sheet History had two Outreach Officers on the ship: Karen Romano Young is a children's author and illustrator, and informal educator, and the creator of a weekly science comic, #AntarcticLog. Vivien Cumming is a geologist as well as a photographer, writer, and filmmaker who tells expedition science stories in the media. The team documented the expedition in real time using film, photo, writing, and interviews. Media coverage included interviews with Co-Chief Karsten Gohl for German science TV Nano on 3sat, which aired on February 20th, 2019, as well as French TV. Photos, interviews and information were provided for 2 German news articles and 2 French news articles. Expedition 379 press releases led to 3 U.S. news stories on the expedition. BBC Earth Instagram published a series of photos from the expedition with an explanation of the scientific objectives. The post reached an audience of over 2.1 million people and was liked by over 40 thousand people. The BBC world service radio interviewed co-chief scientist Julia Wellner.

Expedition 382: Iceberg Alley and Subantarctic and Ocean Dynamics had a team of two Education & Outreach Officers. Marlo Garnsworthy is an author, illustrator, editor, photographer, and science communicator, while Lee Stevens is a videographer, animator, photographer, and science communicator. Professional development of the science team was a significant focus of the education & outreach team, who provided science communication and social media workshops for the shipboard scientists and technicians and worked to develop scientists as writers and bloggers through developmental/substantive editing and consultation. This cruise generated significant media attention, with 13 external newspaper and magazine articles, 2 TV appearances, and 1 radio interview. Co-Chief Maureen Raymo conducted an interview from the *JOIDES Resolution* for CBS's *This Morning,* featured on Earth Day, and other footage was shot to be used by German filmmakers MobyDok for a documentary about sea level rise featuring Co-Chief Mike Weber. Garnsworthy wrote articles for EGU Cryosphere, Oceanbites, and Envirobites and is booked for post-cruise presentations and talks.

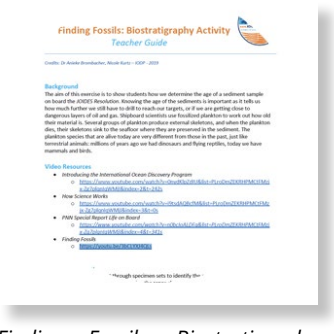
Expedition 383: Dynamics of Pacific Antarctic Circumpolar Current sailed Sian Proctor as the Outreach Officer. Sian is an analog astronaut, geoscientist, and science communicator with a passion for Earth and space exploration. She was a finalist for the 2009 NASA Astronaut Program and has participated in 3 human spaceflight simulations including living for 4-months in a NASA-funded Mars Simulation as the education and outreach officer. Proctor is also a geology, sustainability, and planetary science professor at South Mountain Community College, Phoenix, Arizona. She has a B.S. in Environmental Science, an M.S. in Geology, and a Ph.D. in Science Education. During the expedition, she completed a total of 35 Spotlight blogs that highlighted the careers of the expedition crew members. She assisted scientist Anieke Brombacher, who posted in both English and Dutch; together they posted a total of 48 blogs. The expedition website also has a link to the Columbia University Earth Institute State of the Planet blog series, where co-Chief Gisela Winckler and scientists Julia Gottschalk and Jenny Middleton posted articles about Expedition 383 (https://blogs.ei.columbia.edu/features/ocean-of-extremes/).



Antarctic Log *comic, created by Karen Romano Young, available for download at https://joidesresolution.org/activities/antarctic-log-comic/.*



Iceberg of Antarctica *children's book, created by Marlo Garnsworthy, available for download at https://joidesresolution.org/activities/iceberg-of-antarctica-book/.*



Finding Fossils: Biostratigraphy Activity, created by Anieke Brombacher, available for download at https://joidesresolution.org/activities/finding-fossils/.

IODP Expedition 358: Attempt at Deep Riser Drilling of the Nankai Trough Megathrust Falls Short

Harold Tobin, Hiroko Kitajima, Demian Saffer
(U.S. Science Leaders for Expedition 358)

Introduction

Expedition 358 was literally 17 years in the making; the initial pre-proposal for the Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) was submitted in October, 2001. NanTroSEIZE was conceived from the beginning as a "grand challenge" effort to drill all the way to a subduction zone plate boundary fault zone at earthquake depths, with the goals of sampling the plate boundary fault, making key downhole measurements, and leaving behind instruments in the fault zone environment to monitor time series of physical, chemical, hydrological, and thermal processes. Scientific objectives of the project focused on characterizing the materials and geometry of the active fault zone, as well as the state and variation of stress, temperature, and pore fluid pressure, all to test hypotheses about processes controlling fault locking and slip. Deep drilling using the full capability of the riser drillship *Chikyu* was intended as the centerpiece of a comprehensive multi-expedition and multi-pronged effort to drill a transect from the incoming plate through the relatively shallow frontal thrust region and into the forearc basins that overlie the megathrust fault itself.

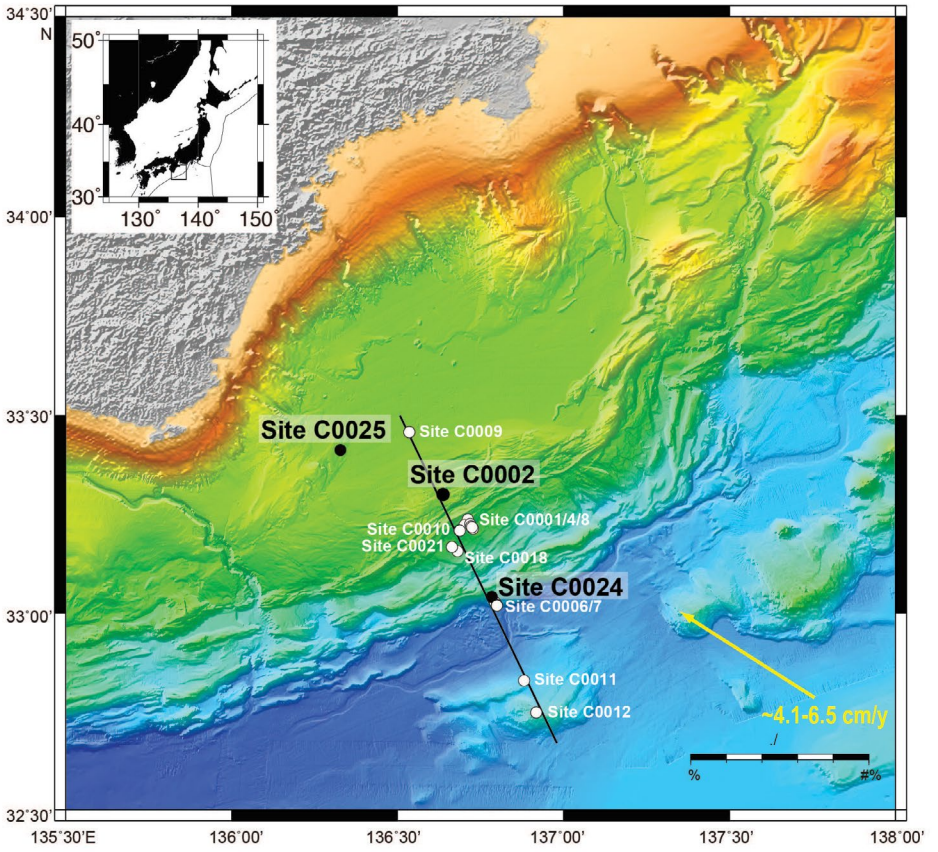


Figure 1. Location of Expedition 358 off Kii peninsula, Japan, with drilled sites in black. Previous NanTroSEIZE sites are shown in white.

In the years from 2007 through 2018, 12 NanTroSEIZE expeditions had accomplished virtually all of the key non-riser objectives of the program: sampling 2 major fault systems at hundreds of meters depth; determining age, evolution, and structure of the accretionary complex; defining the subduction inputs of sediments, rock, and fluids; and installing 3 revolutionary borehole observatories with real-time data streaming back to land. The Nankai Trough off Kii peninsula is now the most intensively studied and best-known subduction zone forearc in the world. More than 100 IODP scientists have participated, publishing over 80 papers on NanTroSEIZE at last count.

Riser Hole C0002F-N-P-Q-R-S-T

What remained for Expedition 358 was to drill the deep riser hole to the plate boundary fault zone, always the principal goal of the program (Figures 1 and 2). Site C0002 (*Chikyu's* second IODP site ever) had been piloted on Expedition 314 in 2007 to a depth of 1405 meters below the sea floor (mbsf), and the upper-most segment of the cased riser hole was begun in 2010 on Expedition 326 in Hole C0002F. A riser borehole is very different from even the most complex of riserless holes familiar to most of us from decades of scientific ocean drilling. At the seafloor, 36-inch diameter casing is installed to support the wellhead, a substantial piece of engineering in its own right that must support the massive weight of the 3-story tall blowout preventer needed to connect the riser pipe to the drill ship through 2000 meters water depth. Below that surface installation, the deep borehole proceeds in stages as sections of hole are drilled with successively smaller-diameter casings and then cemented into place to stabilize and control the well.

IODP Expeditions 338 and 348 (2012 through 2014) had advanced the deep riser hole at Site C0002 to 3058 mbsf, though not without difficulties. In Expe-

dition 338, the main track of that borehole (Hole C0002F) was extended to 2005 mbsf. However, riser drilling operations had to be abandoned due to mechanical and weather-related events. In Expedition 348, a sidetrack (literally milling out the side of the steel casing pipe to shunt the borehole onto a new path, then continuing downward) was started from 860 meters depth in the cased hole. It needed a new hole designation: C0002N. Borehole instability led to the pipe getting stuck below the installed casing of Hole C0002N, so another sidetrack was made from 1937 mbsf, leading to a new hole name—C0002P—even though all 3 holes share the same upper hole and casing for almost 2000 meters! This already complex borehole was the starting point for Expedition 358.

Chikyu sailed with the first members of the Expedition 358 science party on October 8, 2018 to Site C0002. The objective was to start from near the bottom of the 2922 mbsf cased Hole C0002-F/N/P and continue in stages to 5200 mbsf. The hole was already the deepest scientific drilling hole in the world's ocean floor. The expedition was slated to last 160 days, until near the end of March, 2019. We had assembled an unprecedented scientific party for this expedition, with 9 Co-Chief Scientists (or "Science Leaders" as they were dubbed for Expedition 358), and a rotating set of groups of scientists "on call" and helicoptering on and off the ship in intervals (known as Windows 1 through 7) as needed for the operation. Given the complexity and time constraints, relatively little coring was planned; instead, a comprehensive logging-while-drilling (LWD) program and the continuous return of cuttings and gas with mud circulated through the riser system (impossible in normal riserless, JR-style operation) would be used to characterize the formation down to the fault zone. Only 100-200 meters of coring was planned for the main target fault zone and its surrounding wall rocks. An aggressive casing strategy was required as well, including the use of a new technology known as "expandable casing," which is actually installed at one diameter and then "spread" to a larger diameter *in situ*. The science party was fired up and ready to go—the unofficial expedition motto was "Megathrust or Bust!"

Unfortunately, things did not go according to plan from nearly the very start. Because of conditions of collapse in the lowermost borehole (below the bottom of the casing in Hole C0002P) at the end of Expedition 348, the engineering plan was to sidetrack yet again at 2880 mbsf to establish Hole C0002Q and then drill downward. Difficulties making the sidetrack hole, and then passing the complex string of LWD tools into it, were encountered almost immediately. The drilling team wrestled with the sidetracked hole for many weeks but ultimately found that we could not make adequate progress. Hole C0002Q slowly reached 3262 mbsf—another new depth record—and recovered cuttings and some log data, but no cores. A decision was made to pull back up a bit higher in the cased hole and try a new sidetrack—Hole C0002R.

This time, the initial sidetrack was made with ease, but the drill string wouldn't cooperate when trying to "steer" it away from the pre-existing borehole track. After quite a bit of struggle and effort, the first expandable casing was installed, covering only 60 meters of the challenging part of the new hole (it had been planned for ~800 meters). When drilling out the bottom of this new casing, disaster struck—the bit and drill string became irretrievably stuck at the bottom. Twelve intensely frustrating days of trying to free the stuck pipe ensued, but in the end it had to be severed.

At this point in late January, more than 3.5 months—more than half of the expedition time—had already elapsed. We made the decision to make one more try, and Hole C0002S was sidetracked from within the expandable casing. It proved possible to drill ahead in that hole for a few hundred meters, albeit at a very slow rate of advance, but then the steerable drilling assembly and drill bit dropped off into the hole! At this point, LWD drilling was abandoned and yet another, final sidetrack was made, C0002T. Three cores were taken after a short advance but recovery was unfortunately very poor. Although they were taken well short of the previous sidetrack total depth, these are nonetheless the deepest cores below sea floor ever taken by IODP.

Contingency Plans: Sites C0024 and C0025

With about a month remaining in the expedition, the Science Leaders decided to move to 2 non-riser contingency sites. Site C0024 was targeted to access the frontal, shallower portion of the plate boundary decolle-

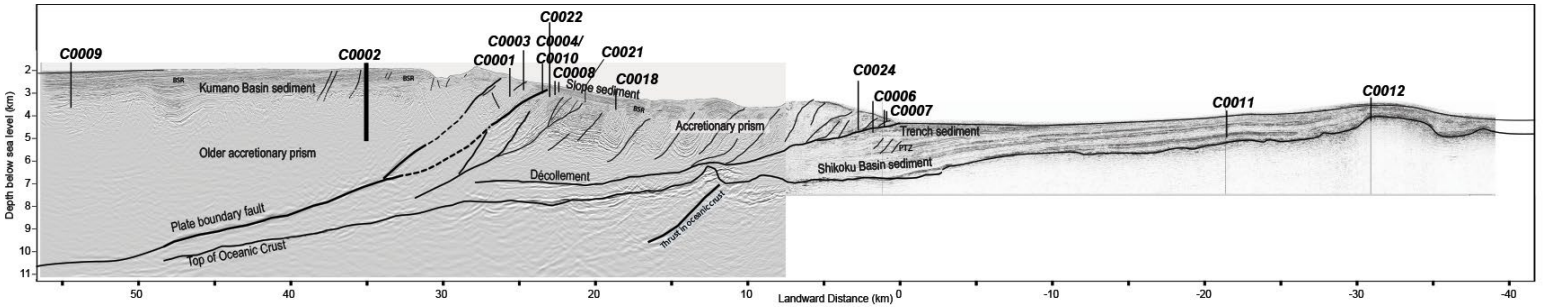


Figure 2. Composite seismic section of the NanTroSEIZE transect.

ment fault at ~820 mbsf near the trench. An initial dedicated LWD hole obtained excellent quality logs (sonic, resistivity imaging, gamma, and vertical seismic profile while drilling). The fault zone was identified in the logs by a zone of complex structure in the lowermost 40 meters of the hole. Drilling terminated with deteriorating hole conditions. A series of holes were drilled in an attempt to core the fault zone and its hanging wall, with partial success. The sediments and structure of the upper part of the hole were sampled, but unstable hole conditions prevented coring of the main fault zone target here too.

In the waning days of the expedition, which had been extended to March 31, 2019, the final site, C0025, was chosen to address questions of the timing of development of the Kumano forearc basin and the tectonic history of the inner accretionary wedge. The site was located where the forearc basin sediments are underlain by a deformed domal or antiformal interval that was hypothesized to represent either: (a) early inner wedge thrust sheet material; or (b) diapiric mud rising into place. Rotary Core Barrel (RCB) drilling was carried out by washing down to 400 mbsf, where coring commenced. Nineteen RCB cores were collected to a total depth of 580.5 mbsf, reached just hours before the 167-day seagoing portion of the expedition finally came to an end.

Finally, 24 scientists boarded *Chikyu* one last time in Shimizu, Japan from July 13-18, 2019 as part of "Window 7" of Expedition 358. Most of those scientists were veterans of 2 or more of the previous windows on the expedition, having helicoptered to and from *Chikyu* multiple times. With hard work by the entire dedicated team, the Site C0025 cores were described and sampled, and the Expedition Report drafts finally completed.

Post-Mortem

Expedition 358 was an undeniably frustrating experience for all, from those who had spent years in detailed planning to the shipboard science party members who maintained very positive attitudes even through long periods at sea without the samples or data they had hoped for. Like any very challenging frontier project, attempting to drill a 5-kilometer hole in the seafloor came with considerable risk, and this time our reach exceeded our grasp. Unfortunately, we were unable to address the scientific objectives because of the operational difficulties encountered continuously throughout the first 4 months of riser drilling. The fundamental scientific questions surrounding the mechanics and evolution of plate boundary faults are, if anything, more relevant than ever today, so we anticipate that efforts to drill again, either here or elsewhere, will continue.

Schlanger Fellows 2019-2020

Meet our 2019-2020 Schlanger Ocean Drilling Fellows! Each of the recipients will receive a $30,000 award to conduct IODP-related research during the 2019-2020 academic year. Additional information on their projects can be found at https://usoceandiscovery.org/fellowships/

Kimberly Beryl deLong

University of California, Santa Cruz

Reconstructing nitrogen cycling and ecosystem structure in the Bering Sea through the anomalously warm, high-productivity, hypoxic Bolling-Allerod Event

Kyle Metcalfe

California Institute of Technology

Mineral-associated microbial ecology of the deep subsurface, Nankai Trough, Japan

Kelli Mullane

Scripps Institution of Oceanography

Investigating the Piezophilic Microbial Communities of Mariana Forearc Serpentinite Mud Volcanoes

Samuel Phelps

Lamont-Doherty Earth Observatory

The role of atmospheric CO_2 in late Miocene environmental change: a multi-proxy study

Srisharan Shreedharan

Pennsylvania State University

Fault healing and shallow slow slip at the Hikurangi subduction margin: the impact of normal stress and loading-rate on friction

Celebrating 50 Years of Scientific Ocean Drilling

Last year marked the 50th anniversary of scientific ocean drilling, an occasion that was commemorated by numerous events and celebrations observed by scientists and research organizations around the globe. From conference sessions to symposia to publications to museum events, the IODP community paid tribute to the many achievements of ocean drilling and shared them with research colleagues as well as the public.

The European IODP community was the first to mark the anniversary with a special session (https://bit.ly/2HqgSgh) at the 2018 conference of the European Geosciences Union (EGU) in April, which featured presentations by Judith McKenzie (ETH Zürich, Switzerland), Ursula Röhl (MARUM, University of Bremen, Germany), Lisa McNeill (University of Southampton, UK), Carlota Escutia (IACT Granada, Spain), Michael Strasser (University of Innsbruck, Austria) and Fumio Inagaki (JAMSTEC, Japan). The speakers reviewed a wide range of ocean drilling achievements since the inception of the program, covering all 4 of the major themes in the current IODP Science Plan.

In September, the Southampton Marine and Maritime Institute hosted an event (https://bit.ly/2LUiLX1) at the National Oceanography Centre Southampton to celebrate the 50-year anniversary, which was followed by a 2-day symposium (https://bit.ly/2VO5cww) hosted by the Natural Environment Research Council (NERC) UK-IODP community at the Natural History Museum in London.

Later in 2018, the Austrian Academy of Sciences held a symposium entitled "50 Years of Ocean Drilling—A Success Story" (https://bit.ly/2ypxpvR), which both looked back on program accomplishments and discussed future challenges and priorities.

Some of the European celebrations spilled over into 2019. In March, the Lapworth Museum of Geology at the University of Birmingham launched a 3-month exhibit (https://bit.ly/2HHHVCz), entitled "Mysteries of the Deep," that paid tribute to IODP and its predecessor programs. In addition, the MARUM core repository marked its 25th anniversary of storing IODP cores with a symposium (https://bit.ly/2w6MiSr) that featured presentations by more than a dozen international speakers.

China commemorated the 50th anniversary of scientific ocean drilling, as well as its own 20th anniversary of involvement with the program, by organizing a November 2018 symposium in Beijing that was attended by 126 scientists, journalists and government officials. The event included over a dozen talks as well as keynote presentations by Pinxian Wang and Zhimin Jian (both of Tongji University) as well as former IODP Forum Chair Jamie Austin (University of Texas at Austin, U.S.). Not long thereafter, a Chinese-language book, largely authored by scientists at Tongji University and entitled "The 50 Years of Ocean Drilling," was released to significant ceremonial fanfare at the Shanghai Science Hall.

In the United States, the 50th anniversary was commemorated by a special session (https://bit.ly/30uLDbC) at the annual Fall Meeting of the American Geophysical Union in Washington, D.C. Featuring addresses by Susan Humphris (Woods Hole Oceanographic Institution, U.S.), Richard Arculus (Australian National University), Katsuyoshi Michibayashi (Nagoya University, Japan), Beth Orcutt (Bigelow Laboratory, U.S., on behalf of Verena Heuer of the University of Bremen, Germany), and Maureen Raymo (Lamont-Doherty Earth Observatory, U.S.), the program reviewed the many achievements of scientific ocean drilling while emphasizing how the past will inform the future.

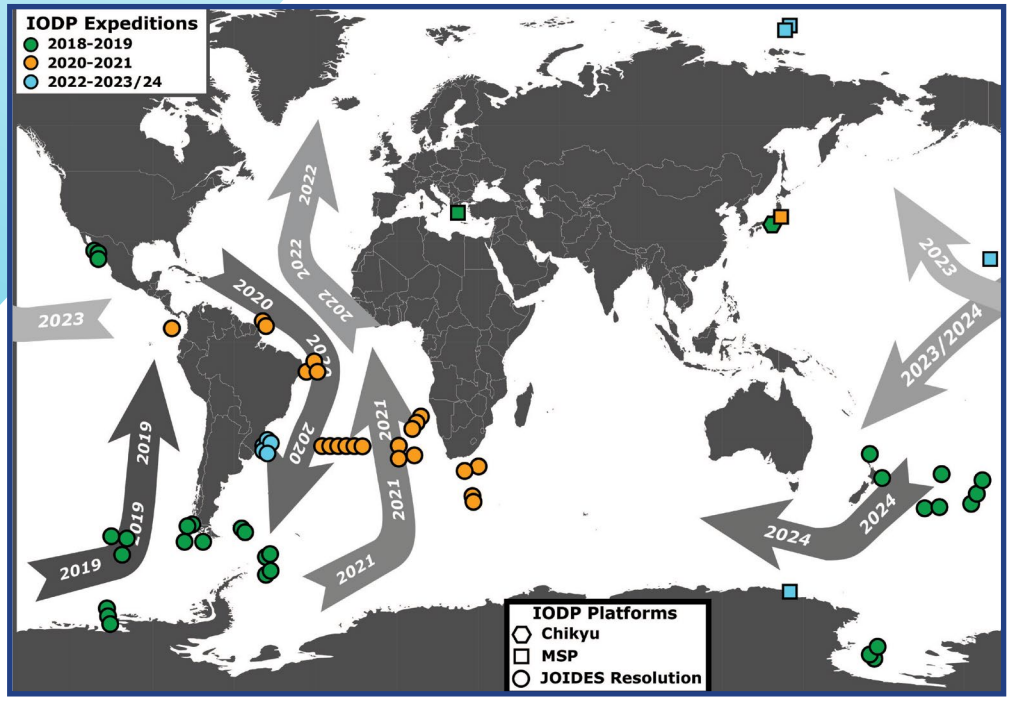
Finally, a special scientific ocean drilling issue (https://tos.org/oceanography/issue/volume-32-issue-01) of the journal *Oceanography* was published earlier this year by The Oceanographic Society. Entitled "Scientific Ocean Drilling: Looking to the Future," the issue was guest edited by Anthony Koppers, Carlota Escutia, Fumio Inagaki, Heiko Pälike, Demian Saffer, and Debbie Thomas, and includes almost 50 articles authored and co-authored by more than 100 researchers who have been involved in scientific ocean drilling since its inception.

2018 - 2021 IODP EXPEDITION SCHEDULE

Platform	#	Expedition	Dates	Ports
	385T	Panama Basin Crustal Architecture (504B) and Restoring Hole 896A	8/18/19 - 9/16/19	Antofagasta, Chile - San Diego, California
	385	Guaymas Basin Tectonics and Biosphere	9/16/19 - 11/16/19	San Diego, California - San Diego, California
	378	South Pacific Paleogene Climate	1/3/20 - 3/4/20	Fiji - Papeete, Tahiti
	384	Engineering Testing	3/4/20 - 4/26/20	Papeete, Tahiti - Barbados
	387	Amazon Margin	4/26/20 - 6/26/20	Barbados - Recife, Brazil
	386	Japan Trench Paleoseismology	TBD	TBD
	388	Equatorial Atlantic Gateway	6/26/20 - 8/26/20	Recife, Brazil - Recife, Brazil
	390	South Atlantic Transect 1	10/5/20 - 12/5/20	Rio de Janeiro, Brazil - Cape Town, South Africa
	391	Walvis Ridge Hotspot	12/5/20 - 2/4/21	Cape Town, South Africa - Cape Town, South Africa
	392	Agulhas Plateau Cretaceous Climate	2/4/21 - 4/6/21	Cape Town, South Africa - Cape Town, South Africa
	393	South Atlantic Transect 2	4/6/21 - 6/6/21	Cape Town, South Africa - Rio de Janeiro, Brazil

JOIDES Resolution
Mission Specific Platform

The *JOIDES Resolution* Ship Track: From Summer 2018 and Beyond



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