International Ocean Discovery Program

JOIDES Resolution Science Operator

FY19 Q4 Operations and Management Report

1 July–30 September 2019

Cooperative Agreement OCE-1326927

Submitted by the JRSO

to

The National Science Foundation

and

The *JOIDES Resolution* Facility Board

14 November 2019

Contents

1. Introduction

This quarterly operations and management report reflects activities and deliverables outlined in the International Ocean Discovery Program (IODP) *JOIDES Resolution* Science Operator (JRSO) FY19 Annual Program Plan to the National Science Foundation (NSF), as implemented by Texas A&M University (TAMU), acting as manager and science operator of the research vessel *JOIDES Resolution* as a research facility for IODP. Administrative services in support of JRSO activities are provided by the Texas A&M Research Foundation (TAMRF) through TAMU Sponsored Research Services (SRS).

2. Expedition operations

This section provides information on the following aspects of JRSO expedition support:

- Planning (including logistics and engineering development);
- Staffing (including a staffing table for expeditions under way during the quarter);
- Clearance, permitting, and environmental assessment activities;
- Expedition operations (including a site map for each expedition under way during the quarter, a coring summary table for each expedition completed during the quarter, and preliminary science results for each expedition that was completed during the quarter); and
- Postexpedition activities (including postcruise editorial meetings).

Table 2.1. JRSO expedition schedule

Expedition		Port (origin)	Dates[1]	Total days (port/ sea)	Days at sea (transit[2]/ ops)	Co-Chief Scientists	Expedition Project Manager
Dynamics of Pacific Antarctic Circumpolar Current	383	Punta Arenas, Chile	20 May–20 July 2019	61 (5/56)	56 (20/36)	F. Lamy G. Winckler	C. Alvarez Zarikian
Non-IODP (JR100)	379T	Punta Arenas, Chile	20 July–18 August 2019	29 (5/24)	24 (8/16)	N/A	L. Childress
Panama Basin Crustal Architecture and Deep Biosphere: Revisiting Holes 504B and 896A	385T	Antofagasta, Chile	18 August–16 September 2019	29 (1/28)	28 (18/10)	B. Orcutt M. Tominaga	P. Blum
Guaymas Basin Tectonics and Biosphere	385	San Diego, California (USA)	16 September–16 November 2019	61 (5/56)	56 (9/47)	A. Teske D. Lizarralde	T. Höfig
Non-IODP (16 November 2019–3 January 2020) (48 days)							M. Malone
South Pacific Paleogene Climate	378	Lautoka, Fiji	3 January–4 March 2020	61 (3/58)	58 (27/31)	D. Thomas U. Röhl	L. Childress
Engineering Testing	384	Papeete, Tahiti	4 March–26 April 2020	53 (5/48)	48 (25/23)	N/A	P. Blum
Amazon Margin	387	Bridgetown, Barbados	26 April–26 June 2020	61 (5/56)	56 (8/48)	P. Baker C. Guizan Silva	E. Estes
Equatorial Atlantic Gateway	388	Fortaleza, Brazil	26 June–26 August 2020	61 (5/56)	56 (2/54)	G. Fauth T. Dunkley Jones	L. LeVay
Non-IODP (26 August–5 October 2020) (40 days)							
South Atlantic Transect 1	390	Rio de Janeiro, Brazil	5 October–5 December 2020	61 (5/56)	56 (14/42)	R. Coggon J. Sylvan	T. Williams
Walvis Ridge Hotspot	391	Cape Town, South Africa	5 December 2020–4 February 2021	61 (5/56)	56 (11/45)	W. Sager K. Hoernle	K. Petronotis
Agulhas Plateau Cretaceous Climate	392	Cape Town, South Africa	4 February–6 April 2021	61 (5/56)	56 (6/50)	G. Uenzel-mann-Neben S. Bohaty	D. Kulhanek

Expedition		Port (origin)	Dates[1]	Total days (port/ sea)	Days at sea (transit[2]/ ops)	Co-Chief Scientists	Expedition Project Manager
South Atlantic Transect 2	393	Cape Town, South Africa	6 April–6 June 2021	61 (5/56)	56 (13/43)	D. Teagle G. Christeson	C. Alvarez Zarikian
Non-IODP (6 June–2 October) (118 days)							
Rio Grande Cone Methane and Carbon Cycling	394	TBD	2 October–2 December 2021	TBD	TBD	TBD	TBD

Notes: TBD = to be determined.

[1] The start date reflects the initial port call day. The vessel will sail when ready.

[2] Preliminary total estimated transit (i.e., to and from operational area and between sites).

Expedition 379: Amundsen Sea West Antarctic Ice Sheet History

Postexpedition activities

The Expedition 379 postcruise core description, editorial meeting, and sampling party were held 15–22 August in College Station, Texas.

Expedition 382: Iceberg Alley and Subantarctic Ice and Ocean Dynamics

Postexpedition activities

The *Preliminary Report* was published in August. Planning is ongoing for the sampling party, scheduled for 18–26 November in Bremen, Germany.

Expedition 383: Dynamics of Pacific Antarctic Circumpolar Current

Table 2.2. Expedition 383 Science Party staffing breakdown

Member country/consortium	Participants	Co-Chief Scientists
USA: United States Science Support Program (USSSP)	9	1
Japan: Japan Drilling Earth Science Consortium (J-DESC)	2	
Europe and Canada: European Consortium for Ocean Research Drilling (ECORD) Science Support and Advisory Committee (ESSAC)	8	1
Republic of Korea: Korea Integrated Ocean Drilling Program (K-IODP)	1	
People's Republic of China: IODP-China	2	
Australia and New Zealand: Australia/New Zealand IODP Consortium (ANZIC)	2	
India: Ministry of Earth Science (MoES)	1	
Brazil: Coordination for Improvement of Higher Education (CAPES)	2	

Figure 2.1. Expedition 383 site map

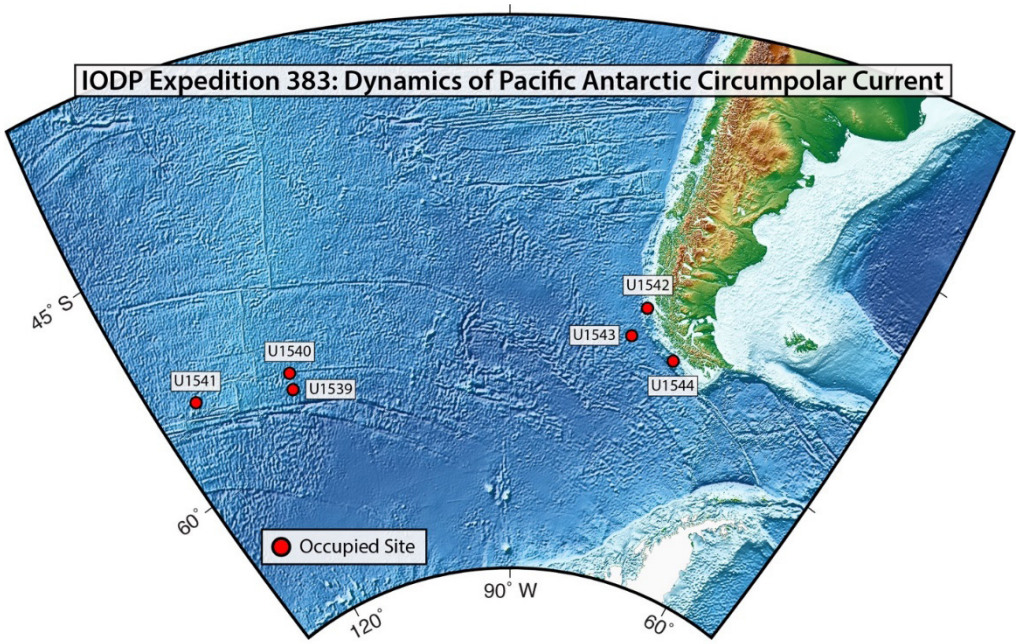


Table 2.3. Expedition 383 coring summary

Site	Hole	Latitude	Longitude	Water depth (mbrf)	Cores (N)	Interval cored (m)	Core recovered (m)	Recovery (%)
U1539	U1539A	56°09.0600′S	115°08.0461′W	4071.08	12	107.6	104.75	97.35
	U1539B	56°09.0587′S	115°08.0276′W	4070.45	3	28.2	21.92	77.73
	U1539C	56°09.0711′S	115°08.0285′W	4070.15	32	268.1	247.50	92.32
	U1539D	56°09.0720′S	115°08.0470′W	4070.13	14	129.3	128.18	99.13
Site U1539 totals					**61**	**533.2**	**502.35**	**94.21**
U1540	U1540A	55°8.4674′S	114°50.5188′W	3584.60	16	150.0	155.13	103.42
	U1540B	55°8.4656′S	114°50.4985′W	3579.98	16	140.0	140.78	100.56
	U1540C	55°8.4474′S	114°50.4994′W	3579.26	1	6.8	6.77	99.56
	U1540D	55°8.4766′S	114°50.5196′W	3577.16	19	152.3	151.02	99.16
	U1540E	55°8.4772′S	114°50.5375′W	3577.16	8	76.0	78.87	103.78
Site U1540 totals					**60**	**525.1**	**532.57**	**101.42**
U1541	U1541A	54°12.7560′S	125°25.5480′W	3606.32	1	9.5	9.67	101.79
	U1541B	54°12.7553′S	125°25.5431′W	3603.72	16	138.5	129.27	93.34
	U1541C	54°12.7566′S	125°25.5288′W	3602.62	13	118.1	100.37	84.99
Site U1541 totals					**30**	**266.1**	**239.31**	**89.93**
U1542	U1542A	52°42.2880′S	75°35.7922′W	1099.81	20	169.5	181.74	107.22
	U1542B	52°42.2893′S	75°35.7551′W	1101.11	1	1.4	1.46	104.29
	U1542C	52°42.2893′S	75°35.7551′W	1100.21	28	225.0	236.86	105.27
	U1542D	52ø 42.3001′S	75°35.7742′W	1100.71	24	202.7	205.04	101.15
Site U1542 totals					**73**	**598.6**	**625.10**	**104.42**
U1543	U1543A	54°35.0631′S	76°40.5900′W	3863.36	36	339.6	350.62	103.24
	U1543B	54°35.0646′S	76°40.5697′W	3865.29	31	283.1	294.97	104.19
Site U1543 totals					**67**	**622.7**	**645.59**	**103.67**
U1544	U1544A	55°32.2192′S	71°35.6194′W	2089.86	19	103.0	91.34	88.68
Site U1543 totals					**19**	**103.0**	**91.34**	**88.68**
Expedition 383 totals					**310**	**2648.7**	**2636.26**	**99.53**

Science summary

The Antarctic Circumpolar Current (ACC) is the world's strongest zonal current system that connects all three major ocean basins of the global ocean and therefore integrates and responds to global climate variability. Its flow is largely driven by strong westerly winds and constricted to its narrowest extent in the Drake Passage. Transport of fresh and cold surface and intermediate water masses through the Drake Passage (cold-water route) strongly affects the Atlantic Meridional Overturning Circulation together with the inflow of Indian Ocean water masses (warm-water route). Both oceanographic corridors are critical for the South Atlantic contribution to Meridional Overturning Circulation changes. In contrast to the Atlantic and Indian sectors of the ACC, and with the exception of drill cores from the Antarctic continental margin and off New Zealand, information on Cenozoic paleoceanography from the Pacific sector of the ACC is lacking from deep-sea drilling records.

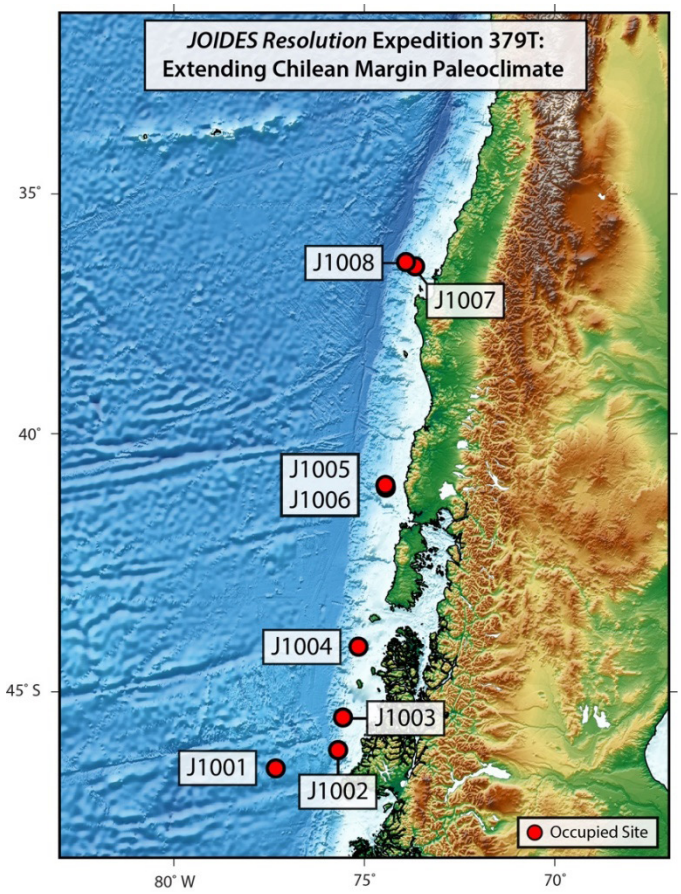
To advance our knowledge and understanding of Miocene to Holocene atmosphere-ocean-cryosphere dynamics in the Pacific and their implications for regional and global climate and atmospheric CO_2, we recovered sedimentary sequences at (1) three sites located in the central South Pacific (U1539, U1540, and U1541), (2) two sites at the Chilean margin (U1542 and U1544), and (3) one site from the pelagic eastern South Pacific (U1543) close to the entrance to the Drake Passage. Because of persistently stormy conditions and the resulting bad weather avoidance, we were not successful in occupying the originally planned Proposed Site CSP-3A in the central South Pacific in the Polar Frontal Zone. The sediments recovered at Sites U1541 and U1543 are as old as the late Miocene, and those at Site U1540 are as old as the early Pliocene. High-sedimentation-rate Pleistocene sedimentary sequences were cored in the central South Pacific (Site U1539) and along the Chilean margin. Taken together, the sites represent a depth transect from ~1100 m at the Chilean margin (Site U1542) to ~4070 m in the central South Pacific (Site U1539) and allow investigation of changes in the vertical structure of the ACC, a key issue for understanding the role of the Southern Ocean in the global carbon cycle. The sites are located at latitudes and water depths where sediments will allow the application of a wide range of siliciclastic-, carbonate-, and opal-based proxies to address the objective of reconstructing with unprecedented stratigraphic detail surface to deep-ocean variations and their relation to atmosphere and cryosphere changes through stadial to interstadial, glacial to interglacial, and warmer than present time intervals.

Expedition 379T: Extending Chilean Margin Paleoclimate (JR100)

Staffing

The science party was provided by the proponents.

Figure 2.2. Expedition 379T site map



Clearance, permitting, and environmental assessment activities

A contact in Chile was engaged to submit the environmental assessment on the JRSO's behalf. The environmental assessment was submitted and was positively reviewed by the environmental agency before the expedition. Authorization from Chile to conduct research in the Chilean Exclusive Economic Zone (EEZ) was obtained on 17 July.

Science summary

Expedition 379T was the first expedition in the NSF-funded "JR100" program, intended to provide the US paleoceanographic community a new structure for recovering long sediment records (up to 100 meters below seafloor) outside of IODP. As such, it bridges between the conventional coring capability of University-National Oceanographic Laboratory System (UNOLS) vessels and the deep-sea drilling program. The primary objective of the expedition was to investigate links between oceanographic changes at the northern margin of the ACC and climate variability on the South American continent over the past few glacial–interglacial cycles with a special emphasis on obtaining high-resolution records of the Eemian interval and the last two glacial terminations. Given very high sedimentation rates along the Chilean margin, the new cores will enable reconstruction of surface and intermediate water variability at centennial-to-millennial resolution, which will extend available records from previous coring expeditions, thus permitting comparison of Southern Hemisphere records of the last and previous interglacial (Holocene vs. Eemian), Terminations I and II, and the MIS 5e–5d glacial inception.

Eight sites were cored during Expedition 379T, recovering a total of 2,232 m of sediment cores in 670–3056 m water depth with an average recovery of 101.8% during 14.62 days of on-site operations. Despite a delayed departure from Punta Arenas, Chile, and several bad weather days that prevented coring at some of the planned sites, almost all of the expedition objectives were achieved. The eight sites extend over a wide latitudinal distance (46°–36°S) covering the modern transition from the Antarctic subpolar to the subtropical zones and spanning water depths intersecting Antarctic Intermediate Water (AAIW), Pacific Deep Water (PDW), and Circumpolar Deep Water (CPDW). Six of the sites are located on the Chilean margin at intermediate water depths (670–1534 meters below sea level [mbsl]), and the other two sites are situated in deep water off the shelf (2032 and 3056 mbsl). Three holes were advanced piston cored (APC) at all but one site (Site J1003 has only two holes), allowing for compositing complete splices for paleoceanographic reconstructions spanning the middle to late Pleistocene (~800–14 ka).

The educational component was another important strength of the JR100 program. Of the 30 science party members, 15 were graduate students and 7 were postdocs, assisted by 6 senior scientists. All members of the science party were trained in and carried out the shipboard analyses and contributed to the interpretations and report writing as is done during regular IODP expeditions. In addition, two undergraduate students were trained by the technical staff and two Chilean observers fully participated in the shipboard analyses.

Expedition 385T: Panama Basin Crustal Architecture and Deep Biosphere: Revisiting Holes 504B and 896A

Planning

Preparations for surface and air freight were completed, and the shipments were dispatched. Port call logistics were finalized.

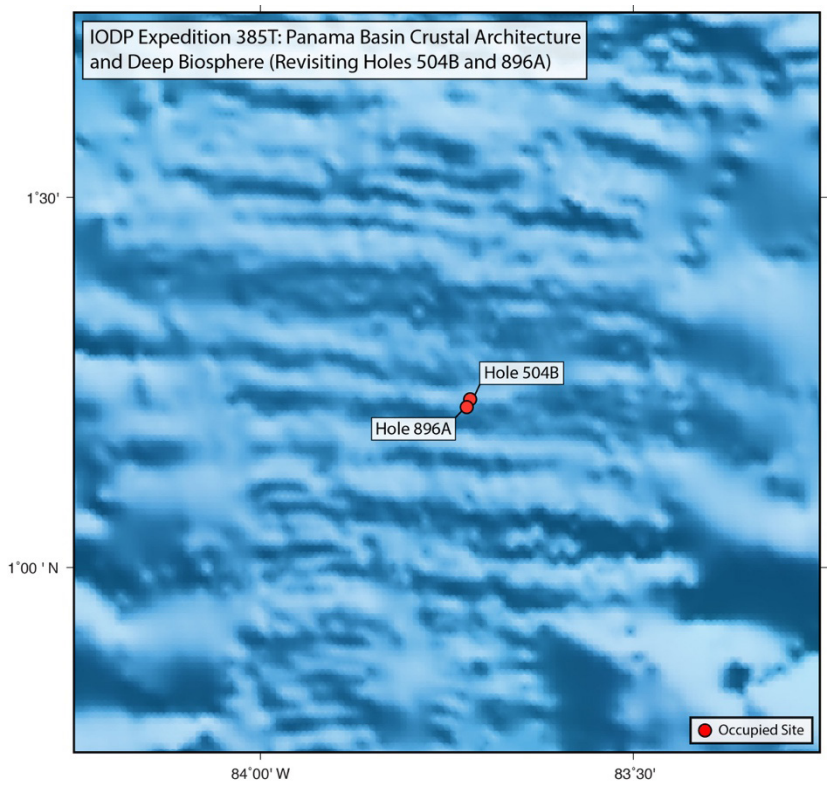
Table 2.4. Expedition 385T Science Party staffing breakdown

Member country/consortium	Participants	Co-Chief Scientists
USA: United States Science Support Program (USSSP)	3*	2
Japan: Japan Drilling Earth Science Consortium (J-DESC)		
Europe and Canada: European Consortium for Ocean Research Drilling (ECORD) Science Support and Advisory Committee (ESSAC)		
Republic of Korea: Korea Integrated Ocean Drilling Program (K-IODP)		
People's Republic of China: IODP-China		
Australia and New Zealand: Australia/New Zealand IODP Consortium (ANZIC)		
India: Ministry of Earth Science (MoES)		
Brazil: Coordination for Improvement of Higher Education (CAPES)		

*Science staffing was limited to the number of scientists required to complete the Ancillary Project Letters (APLs).

The available berthing allowed the US Science Support Program (USSSP) to stage the first JR Academy, which consisted of two instructors and twelve undergraduate students who completed course work in oceanography and geology while being immersed in the science of the expedition.

Figure 2.3. Expedition 385T site map



Science summary

Expedition 385T objectives aimed to take advantage of a transit of the *JOIDES Resolution* from Antofagasta, Chile, to San Diego, California, to accomplish new sampling and data collection from legacy borehole observatories in Deep Sea Drilling Project (DSDP) Hole 504B and Ocean Drilling Program (ODP) Hole 896A on the southern flank of the Costa Rica Rift. In addition, the USSSP organized the participation of three Outreach Officers to evaluate the performance of the *JOIDES Resolution* Outreach Officer program as well as two educators and twelve undergraduate students for a shipboard JR Academy. Our scientific objectives were to collect (1) new Formation MicroScanner (FMS) logs from Hole 504B to improve lithologic interpretations of crustal architecture at this archetype deep oceanic crust hole and (2) fluid samples from both holes to evaluate the crustal deep biosphere in deep and warm oceanic crust. Accomplishing both of these scientific objectives required the removal of old wireline CORK observatories, including associated inflatable packers that were installed in the cased boreholes in 2001. The fluid sampling plan also included testing a new Multi-Temperature Fluid Sampler. Despite successfully removing the CORK wellhead platforms from both holes, we were unable to remove the packers stuck in casing at both locations after 48 h of milling operations in Hole 504B and 2 h of milling operations in Hole 896A, thus precluding accomplishing any of the scientific objectives of the expedition.

Expedition 385: Guaymas Basin Tectonics and Biosphere

Planning

Preparations for surface freight were completed, and the shipments were dispatched. Port call logistics were finalized, including resolving issues with berthing related to high demand in San Diego, California, for the port call week.

Staffing

One science party member was unable to obtain their US visa and didn't sail.

Clearance, permitting, and environmental assessment activities

A list of all scientific participants and their corresponding primary and secondary Mexican embassies/consulates were sent to Mexican authorities as a preparation step for obtaining the required "visa de cooperante." The visa code was not received until 11 September, which caused scientists and technical staff to have to scramble to obtain their visa before leaving home or at the San Diego consulate. Despite the challenges, all participants obtained a visa de cooperante. In addition, it was determined that a brief port stop in Ensenada, Mexico, was required to comply with a US immigration regulation for non-US crew members to clear in a foreign port before returning to San Diego.

Expedition 378: South Pacific Paleogene Climate

Planning

An addendum to the *Scientific Prospectus* was published to document the change in starting port and revised operational plan that resulted from the revision of the schedule due to the replacement of the propellers last year.

Staffing

The Co-Chief Scientists continued working to determine staffing for two positions.

Expedition 384: Engineering Testing

Planning

Orders were placed for the new drilling bits (tricone tungsten-carbide bits, a hybrid roller cone/polycrystalline diamond [PDC] bit, and a PDC bit) and one new underreamer that will be tested during the expedition, including related support equipment.

Clearance, permitting, and environmental assessment activities

The marine scientific research (MSR) application was submitted to the US State Department on 4 September. Required hard copies of the documentation were overnighted to the US Embassy in San Jose, Costa Rica.

Expedition 387: Amazon Margin

Planning

The *Scientific Prospectus* was published in July 2019.

Staffing

Twenty-four invitations were issued, and all scientists accepted the invitation to sail. A special call for a nannofossil specialist was sent out, and two specialists were invited and accepted the invitation to sail. A special call for a paleomagnetist was issued, and one scientist was selected and accepted the invitation to sail. One Onboard Education and Outreach Officer (EOO) was selected and accepted the invitation to sail. Science Party staffing was completed during the quarter.

Clearance, permitting, and environmental assessment activities

The Environmental Evaluation required for Expedition 387 and 388 acoustic activity was approved by the NSF. The MSR application was submitted to the US State Department on 15 July, and the US State Department submitted the application and diplomatic note on 12 August. In additional, a cooperation agreement between TAMU and the Co-Chief Scientist's institution is being developed and will be submitted to comply with clearance requirements.

Expedition 388: Equatorial Atlantic Gateway

Planning

The *Scientific Prospectus* was published in June 2019.

Staffing

First-round invitations were sent out, and twenty-five scientists accepted the invitation. The second-round invitations were sent out 25 August. Interviews were held for the EOO position. Two invitations for the EOO position were sent out and both accepted the invitation.

Clearance, permitting, and environmental assessment activities

The Environmental Evaluation required for Expeditions 387 and 388 acoustic activity was approved by the NSF. The MSR application was submitted to the US State Department on 2 September. In addition, a cooperation agreement between TAMU and the Co-Chief Scientist's institution is being developed and will be submitted to comply with clearance requirements.

Expeditions 390 and 393: South Atlantic Transect 1 and 2

Planning

The pre-expedition meeting was scheduled for 4–6 November in College Station, Texas.

Staffing

Four invitations to sail as Co-Chief Scientist were issued and accepted.

Expedition 391: Walvis Ridge Hotspot

Planning

The pre-expedition meeting was scheduled for 21 and 22 October in College Station, Texas.

Staffing

Two invitations to sail as Co-Chief Scientist were issued and accepted.

Expedition 392: Agulhas Plateau Cretaceous Climate

Staffing

Two invitations to sail as Co-Chief Scientist were issued at the end of the quarter. One was accepted and the other is pending a response.

3. Management and administration

Management and administration (M&A) activities include planning, coordinating (with other IODP-related entities), overseeing, reviewing, monitoring, assuring compliance for, and reporting on IODP activities.

Progress reporting

The JRSO operations and management report for the third quarter of FY19 (April–June) was submitted to NSF on 12 August (http://iodp.tamu.edu/publications/AR/FY19/FY19_Q3.pdf).

Liaison activities

The JRSO reports to and liaises with funding agencies and IODP-related agencies (e.g., *JOIDES Resolution* facility board [JRFB], JRFB advisory panels, Program Member Offices [PMOs]), and other national organizations and facility boards) and participates in facility board, advisory panel, and IODP Forum meetings. Minutes from the facility board meetings are available online (http://iodp.org/boards-and-panels/facility-boards).

Planning meetings

Brad Clement (JRSO Director) and Katerina Petronotis (JRSO Supervisor of Science Support) attended the IODP Forum and PMO meetings held 11–14 September in Osaka, Japan.

Project portfolio management

The JRSO continued work on the JR Communications Update (shipboard very small aperture terminal [VSAT] system replacement), SampleMaster Replacement, and GEODESC Projects and placed the Data Publishing project on hold.

GEODESC

Scope and deliverables

The purpose of the GEODESC project is to replace the DESClogik core description interface, with the principal goal of increasing performance and reliability. The GEODESC Project proposes to design, build, and deliver a new and improved GEODESC tool set.

Status

This project remains on track for completion in February 2021.

Data Publishing

Scope and deliverables

The purpose of the Data Publishing project is to build a framework, tools, and processes capable of publishing expedition data sets for long-term repository storage and discovery of referenceable information. This project will also support publication of data files not currently available online. When completed, all published information will be available for science community use via the JRSO website, a dynamic search engine (similar to Laboratory Information Management System [LIMS] Online Report Environment [LORE]/OVERVIEW), and web-based searches.

Status

Expedition 361 splice and affine data files were added as planned. Recent external feedback suggests the data generated by this project needs to be hosted by a permanent data repository, such as the Zenodo open data repository at the European Organization for Nuclear Research, known as CERN. This project is on hold until a path forward has been determined.

SampleMaster Replacement

Scope and deliverables

The purpose of the SampleMaster Replacement project is to replace the SampleMaster application with a modular program. SampleMaster is an application that provides for all initial IODP data entry into the LIMS database. This interface is used across the organization by a wide range of people who fall into groups of users, and those users perform specific tasks.

Status

The SampleMaster Catwalk Module remains on track for completion by December 2019, and the entire project, comprising multiple modules, remains on track for completion in February 2021.

JR Communications Update

Scope and deliverables

The purpose of the JR Communications Update project is to replace the aging satellite communication system on the *JOIDES Resolution* with the goal of finding a higher capacity service for less cost.

Status

This project remains on track for completion during the November 2019 San Diego port call.

4. Subcontract activities

The JRSO continued to interact with Overseas Drilling Limited (ODL) AS to ensure efficient and compliant operations of the *JOIDES Resolution*. The JRSO and ODL AS executed a restatement of the TAMRF/ODL contract, which simplified the document by removing irrelevant material and condensing amendments into cohesive text.

The JRSO continued to interact with Schlumberger Technology Corporation (Schlumberger) to ensure that wireline logging operations aboard the *JOIDES Resolution* continue in an efficient and compliant manner. The JRSO and Schlumberger worked successfully to streamline travel and shipping activities.

The JRSO recompeted the wireline logging subcontract by issuing a call for proposals. Schlumberger was the sole respondent, and a Letter of Intent was issued to Schlumberger on 17 May. A fully executed contract is in place.

5. Science operations

The Science Operations (SciOps) department provides scientific, operational, engineering, and logistical planning and implementation for *JOIDES Resolution* drilling expeditions in response to the IODP science planning structure. The JRSO is responsible for scoping, planning, managing, and implementing science

expeditions (see Section 2); conducting long-range operational planning for out-year JRSO expeditions; providing services and materials for the platform and oversight to drilling and logging contractors; and utilizing IODP resources to oversee engineering development projects.

Expedition outreach support

JRSO staff assisted with planning for Expedition 385 port call public relations and outreach activities. This was the first port call in the US lower 48 states since Expedition 311 (2005), which provided an opportunity for a wide range of outreach activities, including a symposium and reception at Scripps Institute of Oceanography and ship tours for 160 visitors from various universities in California and Mexico, staff friends and family, TAMU and NSF officials, and local media, which resulted in several news stories.

6. Technical and analytical services

The Technical and Analytical Services (TAS) department develops, maintains, and operates a diverse array of scientific equipment for analyzing cores and core samples; staffs the shipboard laboratories with skilled technicians; provides support for shipboard scientists; assists with downhole tools and measurements; and facilitates shipboard core curation, handling, and shipping.

Analytical systems

X-ray diffractometer

The new Malvern Panalytical AERIS X-ray diffractometer (XRD) was installed alongside the Brüker AXS D4 ENDEAVOR XRD in the X-ray laboratory on the ship. While the Brüker instrument remains serviceable, the ship will have redundant X-ray diffraction capability.

X-ray core section imager

The X-ray Imager (XRI) continues to be of great scientific benefit, and a project charter was submitted for an XRI that would be a standalone system. The new system will leverage linescan imager technology to increase sample throughput, eliminate along-core distortion from detector geometry, and allow entire section images to be captured and uploaded to the science database, analogously to the section half imaging logger (SHIL) color images. Addition of a standalone instrument will better accommodate whole-round and split section core flow and will return the second whole-round logger to “fast track” availability without the existing conflict with X-ray imaging.

Section half imaging logger

A new color linescan camera was purchased in order to try to address the “green flash” that is seen occasionally during use of the SHIL. It will be installed and tested on the Expedition 385T transit to Fiji.

Scanning electron microscope—energy dispersive spectrophotometer

In response to numerous requests from science parties’ evaluations, the JRSO is acquiring a scanning electron microscope—energy dispersive spectrophotometer (SEM-EDS) system for the ship. The NanoImages SNE-4500M will be equipped with a Brüxer XFLASH 630 Mini EDS and will be delivered to JRSO headquarters by the end of the calendar year. This system will replace the Hitachi TM-3000 SEM on the ship, and the older SEM will be transferred to College Station, Texas, where it will be available

for use by visiting scientists and staff. Estimated delivery to the ship is summer of 2020, once workflow, database, and reporting methods are developed.

Laboratory working groups

The laboratory working groups (LWGs) provide oversight, research direction, and quality assurance for the methods, procedures, and analytical systems both on the *JOIDES Resolution* and on shore. The groups meet regularly to review cruise evaluations, expedition technical reports, and any concerns raised by the IODP Issues Management Team and provide advice on corrective actions and potential developments for laboratories.

Curation and Core Handling

The Curation and Core Handling LWG did not meet this quarter because there were no new issues raised for recent expeditions.

Geochemistry and Microbiology

The Geochemistry LWG met twice this quarter to discuss ongoing issues.

Ongoing issues:

- The LWG discussed the purchase of a new XRD as mentioned in the previous section. They reviewed the different vendors' offerings and endorsed the decision to purchase the Malvern-Panalytical AERIS.
- The LWG also discussed the capture and labeling of water samples and creating rules for identification of samples so that their source and capture tool are explicit. Up to now, it has been difficult for a data user to differentiate between interstitial water (IW) squeezed by titanium squeezers, IW obtained from Rhizon samplers, and seawater obtained from the water column or from the borehole using samplers like the Kuster tool. The LWG's recommendations were as follows:
    - Add the tool name to each IW/seawater sample taken to explicitly state how the water was recovered (e.g., squeezer, Rhizon, etc.);
    - Implement the tool column in the sample report and IW reports so that it appears when data are downloaded; and
    - Begin work to define a borehole water report, similar to the IW report, that will only be populated with water not extracted from core material; conversely, the IW report would no longer contain borehole-recovered water data.

Geology

The Geology LWG did not meet this quarter and will meet early next quarter.

Geophysics

The Geophysics LWG did not meet this quarter and will meet early next quarter.

7. Development, IT, and databases

The Development, IT, and databases (DITD) department manages data supporting IODP activities, operates and maintains shipboard and shore-based computer and network systems, and monitors and protects the JRSO network and server resources to ensure safe, reliable operations and security for

IODP data and IT resources. Additional activities include managing expedition and postexpedition data, providing long-term archival access to data, and supporting JRSO Information Technology (IT) services.

Expedition data

LIMS database

Data from Expedition 383 and JR100 were added to the LIMS database on shore this quarter. These data are currently under moratorium and available only to the scientists who sailed on the expeditions. Data from Expeditions 374 and 376 were released from moratorium during this quarter.

Expedition data requests

The following tables provide information on JRSO web data requests from the scientific community. Where possible, visits by JRSO employees were filtered out.

Table 7.1. Top 10 countries accessing JRSO web databases

	Janus database		LIMS database	
Rank	Country	Visitor sessions	Country	Visitor sessions
1	USA	616	USA	1,593
2	China	376	China	322
3	United Kingdom	249	United Kingdom	319
4	France	146	Japan	187
5	Germany	128	Germany	175
6	Australia	92	Unknown	124
7	Norway	79	South Korea	91
8	Netherlands	66	France	80
9	Russia	35	New Zealand	67
10	Japan	33	Russia	61
	Others	266	Others	473
	Total	**2,086**	**Total**	**3,492**

Table 7.2. Top 20 database web queries

	Janus database		LIMS database	
Rank	Query	Views	Query	Views
1	Imaging—core photos	1,171	Imaging—core photos	5,326
2	Chemistry—IW	826	Samples	1,117
3	Site summaries	710	Imaging—LSIMG	778
4	Core summaries	622	Section summaries	534
5	Chemistry—carbonates	547	Imaging—TS images	516
6	Physical properties—MSL	460	Physical properties—MS	512
7	Sample	415	Hole summaries	414
8	Physical properties—GRA	333	Chemistry—IW	400
9	Physical properties—MAD	261	Core summaries	307
10	Physical properties—Color	248	Physical properties—MAD	237
11	Hole summaries	240	Physical properties—GRA	228
12	PMAG	186	Physical properties—RSC	191
13	Physical properties—NGR	166	Chemistry—carbonates	190
14	Special holes	154	XRD	174
15	Site trivia	152	Physical properties—NGR	160

Rank	Janus database		LIMS database	
	Query	Views	Query	Views
16	Paleontology—age models	143	Imaging—microimages	139
17	XRF	143	Imaging—closeups	138
18	Physical properties—PWS	140	SRM section	118
19	Images—prime data	129	Chemistry—ICP-AES	105
20	Physical properties—PWL	122	Gas elements	96
	Others	1,542	Others	11,680
	Total	**8,710**	**Total**	**13,999**

Table 7.3. Data requests to the TAMU Data Librarian

Requests	Total
Photos	5
How to	2
Citations	1
MAD	1
SADR	1
Special holes	1
Photos	5
Total	**11**

Country	Total
USA	4
United Kingdom	2
Australia	1
Canada	1
Denmark	1
Germany	1
Spain	1
USA	4
Total	**11**

8. Core curation

The JRSO provides services in support of Integrated Ocean Drilling Program and IODP core sampling and curation of the core collection archived at the Gulf Coast Repository (GCR).

Sample and curation strategies

The JRSO planned sample and curation strategies this quarter for upcoming JRSO Expeditions 385T and 385 and non-JRSO Expedition JR100.

Sample requests and core sampling

The following table provides a summary of the 1,515 samples taken at the GCR during the quarter. Sample requests that show zero samples taken may represent cores that were viewed by visitors during the quarter, used for educational purposes, or requested for X-ray fluorescence (XRF) analysis. For public relations or educational visits/tours, the purpose of the visit is shown in brackets in the "Sample request number, name, country" column and "No samples" is recorded in the "Number of samples taken" column if no new samples were taken.

Table 8.1. GCR sample requests

Sample request number, name, country	Number of samples taken	Number of visitors
72681IODP, Chang, China	100	
72743IODP, Campbell, Australia	23	
73141IODP, Dutilleul, France	26	
73221IODP, Moris-Muttoni, France	6	
73229IODP, Todd, United Kingdom	56	

Sample request number, name, country	Number of samples taken	Number of visitors
73242IODP, Betts, USA	93	
73253IODP, St. John, USA	7	
73274IODP, Sexton, United Kingdom	14	
73278IODP, Hickey-Vargas, USA	15	
73505IODP, Ijedema, Netherlands	53	
73542IODP, Joseph, USA	0	
73571IODP, Störling, Sweden	6	
73623IODP, Matsumoto, Japan	9	
73652IODP, Kuroyanagi, Japan	90	
73773IODP, Coolen, Australia	30	
73825IODP, St. John, USA	120	
74080IODP, Reinthal, USA	13	
74100IODP, Furukawa, Japan	651	
74205IODP, Herbert, USA	10	
74339IODP, Snyder, USA	0	
73305IODP, Herbert, USA	10	
74427IODP, Kraft, USA	0	
74491IODP, Bin Abraham, United Kingdom	8	
74639IODP, Hodel, France	27	
74657IODP, Obrochta, Japan	0	1
74172IODP, Coolen, Australia	30	
74690IODP, Kodama, USA	5	
74751IODP, Zhy (Yang Zhang), USA	113	
Tours/Demonstrations (5)		95
Totals	**1,151**	**96**

Use of core collection and education and outreach support

The JRSO promotes outreach use of the GCR core collection by conducting tours of the repository and providing materials for display at meetings and museums. The repository and core collection are also used for classroom exercises. In addition, the GCR hosted Summer Safari science camp groups for middle schoolers in July.

Table 8.2. GCR tours/visitors

Type of tour or visitor	Number of visitors
Scientist visitors	1
Educational tours/demonstrations (4)	75
Public relations tours (1)	20
Totals	**96**

Onshore XRF scanning

During this quarter, 423 core sections were scanned on the XRF at the GCR. Documentation relating to the operation, advanced configurations, maintenance, and troubleshooting of the XRF can be found at https://sites.google.com/scientific-ocean-drilling.org/xrf-iodp/home.

Table 8.3. Core sections scanned

Request type	Expedition, name, country	XRF 1	XRF 2	SHIL	WRMSL*
Personal	143, Bohaty, United Kingdom	2	0	0	0
Personal	Non-IODP, van Hengstrum, USA	4	0	58	0
Program	379, Science Party, varied	417	0	0	0
Totals		**423**	**0**	**58**	**0**

Notes: SHIL = Section Half Imaging Logger, WRMSL = Whole-Round Multisensor Logger. *The WRMSL is currently unavailable because it is serving as the development track for a new X-ray system.

9. Publication services

The Publication Services (Pubs) department provides publication support services for IODP riserless and riser drilling expeditions (see Section 2) and editing, production, and graphics services for required Program reports (see Section 3), technical documentation (see Section 6), and scientific publications as defined in the JRSO cooperative agreement with NSF. The Pubs department also maintains legacy access and archiving of Integrated Ocean Drilling Program, ODP, and DSDP publications.

Scientific publications

Table 9.1. Newly published content on the IODP Publications website

Reports and publications	JRSO	USIO	CDEX	ESO*
Scientific Prospectus	10.14379/iodp.sp.387.2019 10.14379/iodp.sp.388.2019 10.14379/iodp.sp.378add.2019			
Preliminary Report	10.14379/iodp.pr.382.2019			
Expedition Reports	10.14379/iodp.proc.376.2019 10.14379/iodp.proc.376.101.2019 10.14379/iodp.proc.376.102.2019 10.14379/iodp.proc.376.103.2019 10.14379/iodp.proc.376.104.2019 10.14379/iodp.proc.376.105.2019 10.14379/iodp.proc.376.106.2019 10.14379/iodp.proc.376.107.2019 10.14379/iodp.proc.374.2019 10.14379/iodp.proc.374.101.2019 10.14379/iodp.proc.374.102.2019 10.14379/iodp.proc.374.103.2019 10.14379/iodp.proc.374.104.2019 10.14379/iodp.proc.374.105.2019 10.14379/iodp.proc.374.106.2019 10.14379/iodp.proc.374.107.2019			
Data Reports	10.14379/iodp.proc.362.202.2019		10.2204/iodp. proc.314315316.224.2019	

*ESO publications are produced under contract with the British Geological Survey.

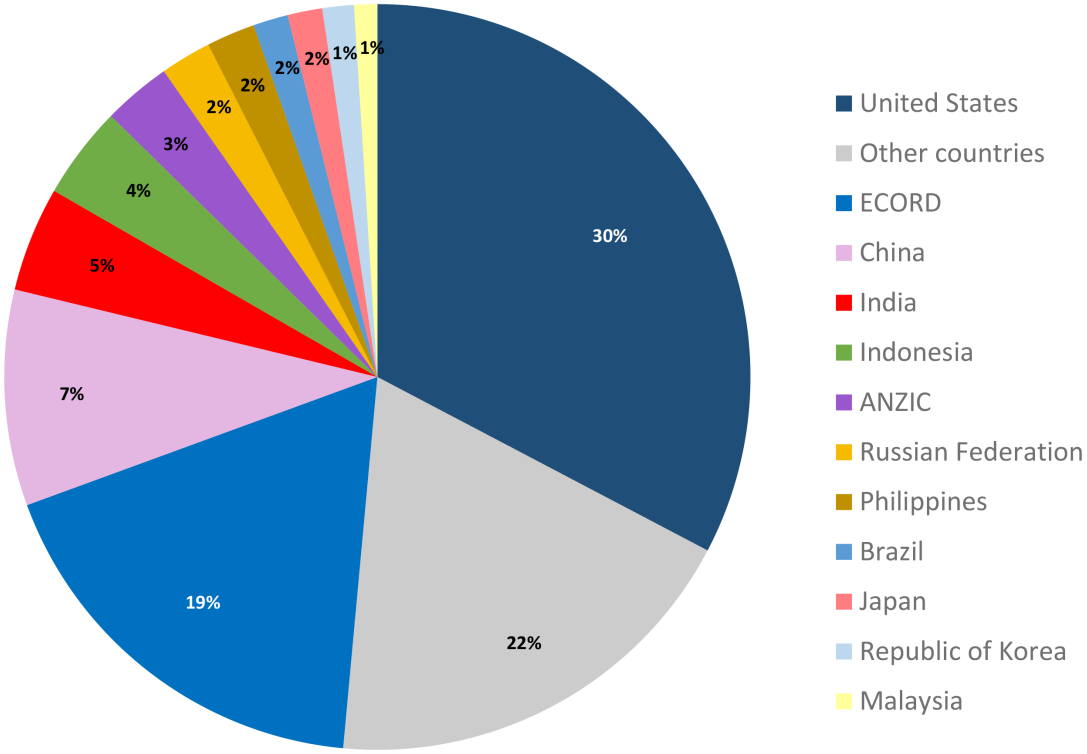
Web services

In addition to internal JRSO web page updates and additions, new content is regularly added to IODP expedition web pages at http://iodp.tamu.edu/scienceops/expeditions.html.

During the last quarter, the IODP TAMU website received 359,018 page views and 46,012 site visits and the IODP Publications website received 301,929 page views and 22,292 site visits. Where possible, visits

by JRSO employees and search engine spiders were filtered out of the counts. Visitors to the IODP TAMU website came from more than 223 countries.

Figure 9.1. Top 12 countries/consortia of visitors to the IODP TAMU website



Notes: ECORD = European Consortium for Ocean Research Drilling. ANZIC = Australia/New Zealand IODP Consortium.
ECORD countries include Austria, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

The ODP science operator, ODP legacy, and DSDP publications websites are hosted at TAMU. Key data, documents, and publications produced during DSDP and ODP are preserved in the legacy websites, which highlight the scientific and technical accomplishments of these ground-breaking precursors to the Integrated Ocean Drilling Program and IODP. The legacy websites contain downloadable documents that cover a wide spectrum of Program information, from laboratory and instrument manuals to Program scientific publications, journals, and educational materials.

Table 9.2. Legacy website statistics

Legacy website	FY19 Q4 page views*	FY19 Q4 site visits*
www-odp.tamu.edu	170,066	22,171
www.odplegacy.org	3,423	1,557
www.deepseadrilling.org	31,975	6,542
Total	**205,464**	**30,270**

*Where possible, visits by JRSO employees and search engine spiders were filtered out.

Publications coordination

Data reports related to Expeditions 314/315/316, 339, 341, 361, 362, 364, 369, and 372B/375 were received, sent to peer review, accepted, and/or published this quarter.

Discovery and accessibility

Digital object identifiers

IODP is a member of CrossRef, the official digital object identifier (DOI) registration agency for scholarly and professional publications. All IODP scientific reports and publications are registered with CrossRef and assigned a unique DOI that facilitates online access. CrossRef tracks the number of times a publication is accessed, or resolved, through the CrossRef DOI resolver tool. Program statistics for the reporting quarter are shown in the table below.

Table 9.3. Number of online DOI resolutions

Reports and publications	DOI prefix	July 2019	August 2019	September 2019	FY19 Q4 total
IODP	10.14379	5,399	5,138	6,009	16,576
Integrated Ocean Drilling Program	10.2204	6,930	7,005	9,782	23,717
ODP/DSDP	10.2973	26,552	22,349	21,065	69,966

Science Open

Integrated Ocean Drilling Program and IODP expedition reports and data reports are indexed at ScienceOpen. IODP deposited data reports from Volumes 346 and 366 into ScienceOpen this quarter.

Table 9.4. ScienceOpen *Proceedings of the International Ocean Discovery Program* collection statistics (https://www.scienceopen.com/collection/IODP_Publications)

Period	Articles added	Article views	Altmetric score (collection)	Number of authors	Referenced articles
FY19 Q1	55	238	135	1,592	
FY19 Q2	8	822	136	1,605	
FY19 Q3	18	1,018	155	1,673	
FY19 Q4	18	714	171	1,745	
Total to date	**712**	**8,382**	**—**	**—**	**8,377**

Table 9.5. ScienceOpen Scientific Ocean Drilling Expedition Research Results collection statistics (https://www.scienceopen.com/collection/8b0582f6-47bf-4988-b90a-8533135e6fcc)

Period	Articles added	Article views	Altmetric score (collection)	Number of authors	Referenced articles
FY19 Q1	74	2,103	16,234	8,563	
FY19 Q2	196	1,247	18,860	8,961	
FY19 Q3	72	1,835	20,342	9,112	
FY19 Q4	1,153	2,565	22,630	10,505	
Total to date	**4,196**	**13,340**	**—**	**—**	**40,473**

Altmetric.com

The JRSO contributes publications metadata to TAMU's Symplectic Elements database, which feeds data to http://altmetric.com, a platform that enables monitoring of the online activity surrounding academic research. This quarter the JRSO uploaded DOIs of Integrated Ocean Drilling Program and IODP *Proceedings* volumes and data reports for Expeditions 352, 355, 362, 369, 371, 372/375, 376, and 381.

Legacy activities

Closeout

Integrated Ocean Drilling Program publications closeout activities continued during the reporting period. Expedition reports and postexpedition research publications published during the quarter in the *Proceedings of the Integrated Ocean Drilling Program* are listed above in "Scientific publications." In addition, publication obligation papers and data reports related to Expeditions 304/305, 313, 314/315/316, 318–320/321, 323–325, 329–337, 339, 341–344, and 346–349 were submitted to English language peer-reviewed journals or the Program.

Publications archiving

The main IODP publications website (http://publications.iodp.org/index.html), which includes full content from all Integrated Ocean Drilling Program and IODP volumes, and other publications pages (http://iodp.tamu.edu/publications) are archived at the Internet Archive, a long-term archive specializing in full website backups. Quarterly crawls incrementally update the archive with new files, which included 41,420 new documents (5.6 GB) for this quarter. In addition, the archive houses legacy publications sites for DSDP and ODP, for a grand total of 1.2 TB of data and 6,756,658 documents. The archive can be viewed at https://archive-it.org/collections/9148.

Citation management

IODP Pubs contracts with the American Geosciences Institute to maintain the Scientific Ocean Drilling Citation Database, a subset of the GeoRef database that contains more than 35,000 records for Program-related scientific ocean drilling publications from 1969 to the present. This quarter, IODP Pubs sent 143 expedition-related publication citations for consideration for inclusion in the database.

Table 9.6. Scientific Ocean Drilling Bibliographic Database statistics

Program-related publications	July 2019	August 2019	September 2019	FY19 Q4 total
Searches	352	411	606	1,369
Citation views	614	546	792	1,952

IODP Pubs also maintains a current PDF list of publications and conference presentations/abstracts authored by JRSO staff and Research Information Systems (RIS)-format citation data lists for IODP program publications and staff-authored journal articles (http://iodp.tamu.edu/staffdir/indiv.html). RIS is a standardized tag format that enables citation programs to exchange data. Users can download the content of the RIS files into most bibliographic software. The IODP program publication and JRSO staff-authored lists are updated quarterly.

Abstracts authored by JRSO staff

Abstracts of conference presentations during this quarter authored by JRSO staff include the following. Bold type indicates JRSO staff (http://iodp.tamu.edu/staffdir/indiv.html).

International Conference on Paleoceanography, 13th

- Griffin, B., McKay, R., De Santis, L., **Kulhanek, D.**, Gales, J., Patten, J., Patterson, M., Prunella, C., Shevenell, A., and the IODP Expedition 374 Scientific Party, 2019. Plio-Pleistocene Antarctic slope current in the outer Ross Sea, and linkages to West Antarctic Ice Sheet variability (presented at the 13th International Conference on Paleoceanography, Sydney, Australia, 2–6 September 2019).

International Nannoplankton Association Meeting, 17th

- **Kulhanek, D.K.**, McKay, R.M., De Santis, L., and the IODP Expedition 374 Scientists, 2019. Calcareous nannofossils from IODP Expedition 374 to the Ross Sea, Antarctica (presented at the 17th International Nannoplankton Association Meeting, Santos, Brazil, 16–19 September 2019).

International Symposium on Antarctic Earth Sciences, 13th

- **Kulhanek, D.K.**, Patterson, M.O., McLaughlin, J., Patten, J., McKay, R.M., De Santis, L., and the IODP Expedition 374 Scientists, 2019. Using sedimentology and geochemistry to elucidate Antarctic Ice Sheet extent in the late Miocene to Pliocene: results from IODP Site U1522 on the Ross Sea continental shelf (presented at the 13th International Symposium on Antarctic Earth Sciences, Incheon, Republic of Korea, 22–26 July 2019).
- Patten, J., **Kulhanek, D.K.**, Griffin, B., McKay, R.M., Patterson, M.O., King, M., Gales, J.A., Prunella, C., Shevenell, A.E., De Santis, L., and the IODP Expedition 374 Scientists, 2019. XRF sediment geochemistry from IODP Expedition Site U1523, outer Ross Sea continental shelf, and its utility to distinguish sediment input from various water masses (presented at the 13th International Symposium on Antarctic Earth Sciences, Incheon, Republic of Korea, 22–26 July 2019).
- Patterson, M.O., Varela Valenzuela, N., Romans, B., Ash, J., **Kulhanek, D.**, Keisling, B., McKay, R., et al., 2019. Assessing the orbital response of the WAIS from a Ross Sea deep ocean perspective since the late Pliocene (presented at the 13th International Symposium on Antarctic Earth Sciences, Incheon, Republic of Korea, 22–26 July 2019).
- Griffin, B., McKay, R., De Santis, L., **Kulhanek, D.**, Gales, J., Patten, J., Patterson, M., Prunella, C., Shevenell, A., and IODP Expedition 374 Scientific Party, 2019. Plio-Pleistocene Antarctic slope current in the outer Ross Sea, and linkages to West Antarctic Ice Sheet variability (presented at the 13th International Symposium on Antarctic Earth Sciences, Incheon, Republic of Korea, 22–26 July 2019).
- McKay, R.M., De Santis, L., **Kulhanek, D.K.**, and the IODP Expedition 374 Scientific Party, 2019. Antarctic Ice Sheet history in the Ross Sea during the Late Cenozoic from geological drill core studies (presented at the 13th International Symposium on Antarctic Earth Sciences, Incheon, Republic of Korea, 22–26 July 2019).

Articles authored by JRSO staff

Program-related science and other articles authored by JRSO staff published during this quarter include the following. Bold type indicates JRSO staff. Other Program-related science articles are available online through the Scientific Ocean Drilling Bibliographic Database (http://iodp.tamu.edu/publications/

bibliographic_information/database.html) and the IODP expedition-related bibliographies (http://iodp.tamu.edu/publications/citations.html).

- Cai, M., Xu, Z., Clift, P.D., Lim, D., Khim, B.-K., Yu, Z., **Kulhanek, D.K.**, Li, T., Chen, H., and Sun, R., 2019. Depositional history and Indian summer monsoon controls on the silicate weathering of sediment transported to the eastern Arabian Sea: geochemical records from IODP Site U1456 since 3.8 Ma. *Geochemistry, Geophysics, Geosystems*, 20(9):4336–4353. https://doi.org/10.1029/2018GC008157
- De Ronde, C.E.J., Humphris, S.E., **Höfig, T.W.**, Reyes, A.G., and the IODP Expedition 376 Scientists, 2019. Critical role of caldera collapse in the formation of seafloor mineralization: the case of Brothers volcano. *Geology*, 47(8):762–766. https://doi.org/10.1130/G46047.1
- Fagereng, A., Savage, H.M., Morgan, J.K., Wang, M., Meneghini, F., Barnes, P.M., Bell, R., et al. (including **K. Petronotis** and **L. LeVay**), 2019. Mixed deformation styles observed on a shallow subduction thrust, Hikurangi margin, New Zealand. *Geology*, 47(9):872–876. https://doi.org/10.1130/G46367.1
- Gray, M., Bell, R.E., Morgan, J.V., Henrys, S., Barker, D.H.N., and the IODP Expedition 372 and 375 Science Parties (including **K. Petronotis** and **L. LeVay**), 2019. Imaging the shallow subsurface structure of the North Hikurangi Subduction Zone, New Zealand, using 2-D full-waveform inversion. *Journal of Geophysical Research: Solid Earth*, 124(8):9049–9074. https://doi.org/10.1029/2019JB017793
- McKinley, C.C., Thomas, D.J., **LeVay, L.J.**, and Rolewicz, Z., 2019. Nd isotopic structure of the Pacific Ocean 40–10 Ma, and evidence for the reorganization of deep North Pacific Ocean circulation between 36 and 25 Ma. *Earth and Planetary Science Letters*, 521:139–149. https://doi.org/10.1016/j.epsl.2019.06.009

Appendix: JRSO quarterly report distribution

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