2019 Co-Chief Review of JRSO FY18 Operations

25–26 Feb 2019
JOIDES Resolution Science Operator
Texas A&M University, College Station, TX

Expeditions (FY18)

Expedition 369: Australia Cretaceous Climate and Tectonics

Brian Huber and Richard Hobbs

Expedition 372: Creeping Gas Hydrate Slides and Hikurangi LWD

Ingo Pecher and Philip Barnes

Expedition 374: Ross Sea West Antarctic Ice Sheet History

Robert McKay* and Laura De Santis

Expedition 375: Hikurangi Subduction Margin Observatory

Demian Saffer** and Laura Wallace***

Expedition 376: Brothers Arc Flux

Cornel de Ronde and Susan Humphris

* Attended review of Expedition 374 by Zoom
** Monday only
*** Did not attend

Executive Summary

The FY18 co-chiefs would like to recognize the *JOIDES Resolution* Science Operation (JRSO) for providing an exceptional, well-maintained, and constantly improved platform that provides the scientific community with a unique facility to pursue a wide range of topics in the Earth and Life Sciences. The *JOIDES Resolution* (JR) facility is run at a very high standard: all personnel involved with the expeditions were professional, well qualified, and dedicated; the infrastructure, logistics, and solution-oriented planning associated with expeditions were efficient and cost-effective; and the management of the JRSO very professional. We are all very grateful to have had the opportunity to participate in this exceptional international program.

The FY18 co-chiefs had overwhelmingly positive experiences with their expeditions. All 2018 expeditions were successfully completed with the exception of Expedition 374, which had a significant (39%) loss of operational time due to a mechanical breakdown of the seals in the port stern tube of the vessel that forced the premature termination of all drilling operations. This problem prevented all objectives as originally envisioned for Expedition 374 being

achieved. Nevertheless, the sediment cores recovered represent a unique and unprecedented, high-resolution, high-recovery paleoclimate record from the Antarctic margin. Despite the frustration, the co-chiefs thank the JR crew and JRSO technical staff for constant updates on the situation and for making all possible effort to repair the damage, and look forward to rescheduling of some time to continue efforts to meet the original Expedition 374 objectives.

1. Co-Chief Review Process

This is the fourth year of an annual format for the co-chief's review of JRSO operations. We very much appreciated having the 2017 and 2018 reviews available to us prior to the meeting, as they provided a context in which to frame our discussions and recommendations.

We recognize the importance of this meeting and appreciate the opportunity provided by the JRSO who, at its expense, brought us all together to openly discuss potential improvements in operations in a constructive and supportive environment.

Recommendation 1-1:

We support the continuation of the annual co-chief scientists' review of JRSO operations, and strongly encourage all co-chiefs to attend in person, as face-to-face interactions are most productive. However, at times when schedules preclude a co-chief's participation, we recommend that remote participation be available for that individual to attend future meetings.

2. Clearances

Obtaining the appropriate clearances for the *JOIDES Resolution* to undertake expeditions in specific regional waters is a significant task undertaken by the JRSO. We support the new hire of a JRSO staff member specifically to assist in this process. During FY2018, clearances were required from New Zealand (Expeditions 372, 375, and 376) and Australian (Expedition 369) government agencies, as well the Antarctic Treaty agencies via NSF (Expedition 374). To assist the JRSO, information and advice was provided by co-chiefs or relevant experienced national scientists.

For one application (Expedition 376), some issues with the Environmental Protection Authority (EPA) and local tribal Iwi were encountered, but these were resolved through direct meetings between affected parties. *The co-chiefs wish to express their appreciation of the significant workload and efforts by the JRSO to successfully navigate the various clearance documentation requirements.* These efforts included successful authorization to use the logging radioactive source in the Ross Sea Marine Protected Area (MPA) (Expedition 374) and assistance with late-stage requests for permission to drill at new sites during two expeditions (Expeditions 369 and 376).

The experience with New Zealand biosecurity authorities (MPI) during Expedition 372, during which hull cleaning of bio-foul on the JR was required, highlights the possibility that clearance issues may arise unexpectedly and at short notice. We support the current approach by the JRSO of close liaison with relevant national representatives who can assist in staying apprised

of relevant national requirements.

3. Staffing the Expedition

The JRSO and PMOs provided co-chiefs and the EPM with a good selection of science party candidates of varying experience and specialization, and were largely considerate of potential conflicts between their rankings and our selections. Some member nations offered few applicants from whom to select, and the vetting/recommendation process was highly variable between PMOs. Some problems arose with a few science party members who had less experience than we were led to believe by their applications.

Recommendation 3-1:

We recommend that the PMOs be encouraged to solicit more, and a wider diversity of, applications when there are insufficient submissions and/or the applicant is not suitable.

We found occasional disconnects between shipboard and shore-based E&O team oversight, partly related to the process of staffing and orientation of these individuals—particularly a lack of clarity about the roles and communication between co-chiefs and staff scientist, and the USSSP E&O group.

We learned during the co-chiefs' review meeting that in the future, co-chief scientists and E&O officers will be counted against the science quota of the member country nominating them for these positions. Concern was raised that this could negatively impact smaller members of the consortia in particular, with outreach being most vulnerable. It will still be important to select co-chiefs on the basis of their knowledge of the area and their role in leading the successful proposal efforts.

Recommendation 3-2:

We request that our concerns about this issue be raised at the annual PMO meeting in order to discuss ways that visibility of the program in member countries/consortia be enhanced through coordinated actions of E&O networks from different member countries/consortia.

4. Pre-Expedition Roles and Communication

Two expeditions (369 and 372) included an ancillary project letter (APL). One of those expeditions (372) was linked to another expedition (375) so that results from the former expedition were needed for successful implementation of the latter.

Balancing priorities between full and ancillary projects: APLs are defined as typically taking up 10%–15% of the operational time of a standard 60-day expedition. Once scheduled, APLs are considered equal priority to the full proposal underpinning the host expedition. During Expedition 369, operations at the APL site took place first and took more time than planned, impacting the host expedition. There was a fear that the overall expedition would not meet expectations due to lack of clarity of APL priorities.

Coordination between linked expeditions: Two expeditions (372 and 375) were linked, and the science parties were combined. Expedition 372 focused on acquiring data that constituted

a part of the science objectives from the drilling proposal that formed the core of Expedition 375. An APL was also included in Expedition 372. Voyage planning and prioritization of planned operations between the two research initiatives (full and ancillary) for Expeditions 372 and 375 went smoothly and were generally well coordinated. This cooperation was facilitated by holding a joint pre-cruise meeting. With time pressure during Expedition 372 resulting from downtime, the science leadership faced some unusual prioritization challenges to balance the operations appropriately across the two proposal objectives. These challenges were resolved among the four co-chief scientists and the JRSO.

Recommendation 4-1:

Proponents of APLs should be involved in the development of the *Scientific Prospectus.* This could be achieved face-to-face or in a conference call.

Recommendation 4-2:

For complex, linked expeditions, a detailed prioritization of sites, and of objectives "within" sites, should be developed and documented in the *Scientific Prospectus.* These should be documented with as much granularity as possible, with co-chiefs being encouraged to explore a number of negative-impact scenarios. Linked expeditions could also benefit greatly from additional face-to-face planning meetings between co-chiefs and their Expedition Project Manager (EPM), Operations Superintendent, and any other JRSO staff involved in the expedition.

Pre-expedition communication and training: IODP is a program that benefits greatly from having an international scientific community on board the JR. However, it is sometimes difficult for non-native English speakers (particularly those who have never been to sea before) to absorb the vast amounts of information presented in the first few days on board the vessel about how the labs operate and the responsibilities of shipboard scientists. This could be helped by improving pre-expedition communication with the help of PMOs.

Recommendation 4-3:

We recommend to the PMOs that they consider organizing pre-cruise meetings for upcoming shipboard party members that introduce the roles and responsibilities of participants and expected workflow on board the JR in their native language. These could be done in groups or as one-on-one with a previous IODP participant.

5. Technical and Engineering Support

Technical and Engineering Support was excellent and underpinned the success of the expeditions that involved some very challenging sites. The co-chiefs recognize the importance of the highly motivated and engaged technical and engineering team. The move to provide an interactive means to maintain manuals for the on-board instrumentation is welcomed. However, it was felt that for some expeditions, communications with the co-chief could be improved for the night-time hours while the Operations Superintendent and Drilling Supervisor were off-duty.

Recommendation 5-1:

Ensure that the co-chief on watch has a clear understanding of who the contact person is for updates on the status of drilling during the night-time hours.

6. Improving Technical Capability and Tools

We recognize the added value for JRSO to employ tools from third parties (e.g., in the case of Expedition 376, a collaboration with MB Century, NZ, allowed successful deployment of the Kuster fluid sampling tool), and we support exploring and enabling these kinds of opportunities for future expeditions.

We recognize the value of employing the extended core barrel (XCB) system in glacial sediments too stiff to be penetrated with piston coring and too soft to be drilled with the rotary core barrel (RCB). However, issues with shattering of core liners during Expedition 374 XCB coring caused problems.

Recommendation 6-1:

We recommend the JRSO investigate the cause of shattered core liners with XCB coring and develop a possible solution in replacing the current liners used for coring in polar regions.

7. Observatories

Two CORK borehole observatories were successfully installed during Expedition 375 after several years of careful design, planning, and development. This was a major success. However, three CORK-related technical issues are nevertheless noteworthy, as they have implications for future CORK installations:

A. Observatory (CORK-II) release tools were a problem at one of the sites: difficulty disengaging with the J-tool. The difficulty disengaging with the J-tool at Site U1519 damaged the CORK-II wellhead (it is now slightly twisted and bent), although it is hoped that this is largely cosmetic. The hydraulic release tool (HRT) worked reasonably well at Site U1519, but at Site U1518 the valve designed to prevent fluid "reflux" didn't function properly and as a result, circulation while drilling-in and running the ACORK 10 5/8" casing led to a large volume of cuttings in the casing after landing. Drilling fluid was visibly billowing out of the top of the tool as we ran into the hole. We were able to clean out the casing but it took some extra time, and it is not clear yet if this posed a problem with regard to fouling of screens or other elements inside the casing.

Recommendation 7-1:

We recommend a review of the J-tool, and consideration be given to moving to HRT for all casing and wellheads if possible.

B. The ROV platform at one site did not land properly on the CORK. In retrospect, we believe that the platforms are probably unnecessary for most CORKs (unless there is a need for platform space to lay out or place batteries or other equipment), as ROVs rarely use themanymore. The inner diameter of the ROV platform was large relative to

the ACORK flange, which provided ample clearance, but also the opportunity to hang up at an angle.

Recommendation 7-2:

We recommend that PIs be informed about this potential issue with the ROV platform during engineering design phase for observatories. One solution would be to remove ROV platforms from the standard plan for CORKs unless they are deemed essential. A second option would be to incorporate a tapered joint above the ACORK or CORK head to ensure that the platform remains aligned and centered as it descends (free falls) to avoid it becoming crooked and hanging up.

C. During CORK deployment at Site U1518, the reentry funnel was inadvertently bumped and, because of seafloor topography, the funnel and mud skirt slid ~5–7 m away from the hole that had been drilled. At the time, there was ~400 m of casing hanging with three screened joints and an umbilical strapped to the exterior, so recovery of the casing string to re-drill a new hole for casing and observatory deployment was not a viable option. Fortunately, the original plan included an underreamer in the assembly to "escort" the casing in if needed. This proved to be an important planning decision, as we successfully drilled a completely new hole (i.e., we drilled-in the casing) to deploy the observatory. It is possible that this generated an unusually large volume of cuttings and may be related to item #1 above.

Recommendation 7-3:

We recommend that, for future observatory installations, the JRSO consider having the "insurance" policy of an underreamer (preferably a new one). The bad timing of heave during reentry was probably unavoidable, but more detailed bathymetry could have helped to site the hole on a flatter slope and minimize the chances of the mud skirt "sledding" away.

Depending on the outcome of initial data collection from the pressure sensors, the Expedition 375 co-chiefs may be able to provide additional insight into whether drill-in casing is a safe option for casing with external screens and umbilical.

8. Labs and Equipment

Regular laboratory crossover meetings are considered essential when coring operations are under way, as they provide a valuable opportunity for communicating observations and discussing problems, ideas, and interpretations among the different laboratories and between the different shifts. They are also useful for announcing any changes in drilling operations or other news that will be of interest to the shipboard party.

Recommendation 8-1:

The microphone and sound system in the laboratories need to be fully operational to overcome ambient noise. We recommend that the technical staff ensure that scientists are familiar with the operation of the sound system so that it is available for use at any time.

Obtaining meaningful thermal conductivity measurements has been problematic during multiple expeditions because of two likely issues: instrument location and user inexperience. Repeated efforts to obtain reliable measurements can significantly slow down the laboratory work flow, causing delays that propagate through the shipboard measurements laboratories.

Recommendation 8-2:

We recommend that JRSO review the location of the thermal conductivity equipment to optimize the stability of the measurements. In addition, we recommend that all users receive sufficient instruction and training to allow for consistent and reliable measurements.

The quality of thin sections made on the ship is variable depending on the training and experience of the assigned laboratory technician. Poor thin section preparation, with some that are too thin or thick and others with portions that are plucked, requires redoing them before they can be of any scientific use. The JRSO should consider whether staffing of the thin section tech, and the practice of rotating all techs among the labs, is consistent with providing the best quality thin sections, which are critical in core description of some rock types.

Recommendation 8-3:

We recommend that the JRSO reconsider their staffing rotation model for the thin section tech in order to ensure that only individuals skilled in thin section preparation of varying lithologies are assigned to the thin section lab.

The shipboard XRD is often critical to characterization of some rock types, but technical breakdowns have caused considerable frustration during several expeditions.

Recommendation 8-4:

We recommend that the XRD be replaced in the near future, and ensure that it is from a vendor that is responsive to repairing things quickly.

9. IT/Software/Databases

Several of the expeditions had unfavorable experiences with the DESClogik core description interface, and we are pleased to hear that a replacement for DESClogik is being sought. There was consensus that it is better to work with a common tool rather than individuals having their own Excel spreadsheets, with their own formats, rendering it difficult to integrate with the JRSO system tools and software. However, several groups (e.g., palaeontologists, glacial sedimentary facies workers, hydrothermal alteration specialists) found the current system was not overly flexible for their needs. While we recognize adaptation of DESClogik is the responsibility of scientists to resolve internally, co-chief and EPMs regularly noticed various inconsistencies in the review process. The current project to replace DESClogik needs to ensure that there is sufficient consultation with external experts, possibly through a working group (e.g., the PSICAT software used on ANDRILL appears more flexible with regards modification during expeditions).

Recommendation 9-1:

We recommend that: (1) expert working groups be consulted during testing of the replacement application to make sure that it adequately addresses previous problems encountered in DESClogik; (2) the best safeguards be built into DESClogik upgrades/replacement to prevent the need for multiple entries; (3) better data import function and an improved interface, and direct saves to LIMS of SEM images, etc., should be included to save considerable time; and (4) more uncommon templates (e.g., hydrothermal, glacial facies) should be stored for future expeditions.

There were some specific issues during the LWD-focused Expedition 372 of insufficient Techlog and Petrel licenses for the size of the logging and seismic science party, and what versions of the software were aboard the JR. There was also a lack of up-to-date user manuals and technical support available for Techlog software.

Recommendation 9-2:

We recommend that the software versions of Techlog and Petrel aboard JR should be updated to latest available, and that up-to-date user manuals and technical support are offered on board the JR. All participants should be advised pre-expedition as to the version of the software that will be used on board the JR. We also recommend that consideration be given to purchasing temporary Techlog and Petrel licenses from Schlumberger for specific expeditions.

Images shown on the TV screens in the science office are of very poor quality, making it difficult to monitor what is happening on the rig floor.

Recommendation 9-3:

We recommend that the external cameras monitoring rig floor operations be replaced with higher resolution cameras, and/or the screens in the Science Office be replaced.

10. Logging

Logging and LWD: Interaction with Schlumberger loggers ranged from excellent to uncooperative. It was noted that for some expeditions, the Schlumberger tech was working up to 24 hours during logging operations.

In LWD pre-expedition planning, the JRSO consulted with co-chiefs and EPMs regarding availability of LWD tools from Schlumberger. Some aspects of the precise data delivery and BHA configurations were, however, only resolved at the beginning of the survey.

Key LWD scientists felt that better communication between the rig floor, LWD engineers, JRSO operations, and the safety monitors could have led to improvements in some data quality.

Recommendation 10-1:

We recommend that JRSO, co-chiefs, and EPMs engage more closely with key LWD scientists from the science party to resolve data stream and BHA configurations in as much advance as possible.

Recommendation 10-2:

We recommend that LWD operational communications be clearly established at the pre-drilling site toolbox meetings.

Downhole measurements: One of two deployments of the temperature dual pressure (T2P) successfully measured formation pressure. Problems, however, occurred during deployment and retrieval. Deployment of the sediment temperature pressure (SETP) was not successful due to flooding and issues with data transmission.

Recommendation 10-3:

We recommend a review of standard testing and operating procedures of the T2P and SETP. In addition, we recommend further development and test deployments of these tools.

11. Paleomagnetic Orientation Data

The magnetic orientation tool (MOT) used for azimuthally orienting core had mixed results on expeditions. During Expedition 374, the MOT performed poorly for the 30 cores on which it was used. This was expected, however, given the steepness of the geomagnetic field at the Expedition 374 sites, which results in the horizontal component (the magnetic declination) being only a small part of the total vector field. Thus, only small errors in the MOT could result in large differences in the estimated core declination, making it a less than ideal tool for high-latitude sites. We were pleased to learn at the meeting that JRSO has recently started a project to build a gyroscopic orientation tool.

12. Curatorial Procedures

Curation and sampling were generally excellent. During the year, there were examples of a variety of sampling strategies from wholly on-board sampling to post-cruise sampling parties programmed to precede the editorial meeting. How sampling is managed is partly dependent on the scientific objectives and on the preferences of the Sample Allocation Committee.

It was recognized that managing sampling parties during the cruise is difficult as, at the time, the total amount of core is not known. This can lead to oversampling of the earlier cores, and individuals ending up with more samples than they can reasonably analyze after the final sampling party.

There was some confusion regarding what samples could be taken for shipboard vs. shore-based analyses. The agreed policy needs to be made clear and repeated as necessary to ensure compliance. At post-cruise sampling parties, some core surfaces had altered due to salt growth, obscuring features noted on the ship and in core scans. These core scans were also of variable quality, and we recommend that more time is given to training on the Section Half Imaging Logger (SHIL) system or that imaging is done with oversight of an expert to achieve a more consistent result.

13. Education and Outreach

While not the responsibility of the JRSO, we recognize that Education and Outreach (E&O) are

imperative to the continued support of the program. In fact, a preferred scenario for IODP would be a more coherent plan for these activities that transcends national and consortia boundaries. However, that can be achieved only through concerted efforts to define common goals and objectives among the PMOs.

Experiences among the co-chiefs with shipboard educators was in general very positive and they were very engaged. However, occasionally, a participant's contribution was clouded by a lack of preparation and uncertainty as to the E&O priorities for the expedition. Whereas the USSSP has increased its efforts to map out the overall E&O objectives and constituencies (which may be too many) served by the E&O program, and then to place expedition-specific activities within this overall framework, a more coordinated annual plan could provide the educators with more direction and result in less repetition. In addition, there are currently no metrics defined on which success of the E&O efforts can be determined.

Recommendation 13-1:

We support the continuation of E&O programs as an important part of the ship-based activities on every *JOIDES Resolution* expedition

Recommendation 13-2:

We recommend that USSSP provide more guidance to the educators on the overall goals of the E&O program, and the expedition-specific activities that are desirable towards achieving those goals. In addition, metrics need to be put in place that enable assessment of the success of the overall E&O program.

It is also important that the educators are made aware that they are considered members of the shipboard scientific party and as such, report to the co-chief scientists while at sea.

Recommendation 13-3:

We recommend that prior to, and during, the expedition, communication between USSSP, EPM, the co-chiefs, and the educators be improved to ensure common expectations of the planned E&O activities and to help maintain the appropriate supervisory relationships.

14. Publications

The publications process is running very smoothly: the co-chiefs receive clear support and directives in terms of preparation of the *Scientific Prospectus,* and the expedition scientists receive good support and instruction while at sea.

The first post-expedition meeting to edit the Proceedings volume is extremely important—it is the only way to get the dedicated and focused attention of a subset of the shipboard scientific party to review the Proceedings in a timely fashion. In addition, the on-site venue of this activity provides useful interaction and decision-making with support from the very responsive IODP publications team.

Recommendation 14-1:

We recommend that the Proceedings editorial meetings continue to be held at JRSO to ensure dedicated and timely attention to reviewing the contents of the volume with support from the IODP publications team.

15.Safety Drills

Currently on joining the *JOIDES Resolution*, there is a safety briefing provided in the conference room that is combined with a weekly muster station call with some additional instructions on evacuation procedures. Although considered adequate, we recommend some additional steps be taken that could improve the effectiveness of safety drill training.

Recommendation 15-1:

When outside and in windy conditions, it is difficult to hear the instructions especially if you are not close to the instructor. We recommend that training be delivered in smaller groups than is currently done to ensure that everyone can hear the instructions.

Recommendation 15-2:

We recommend that all science personnel be required to put on a survival suit as part of the safety briefing.

Recommendation 15-3:

The training is largely centered around the lifeboat, as this as the preferred means to evacuate the ship. However, we recommend that more training be given to using emergency life-rafts and information on general sea survival. Additionally, the JRSO might consider making a request to PMOs to recommend that sea-going scientists attend a basic one-day sea survival training course.