JRSO Operations Co-Chief Review; FY 2019

IODP Expeditions with JOIDES Resolution in FY2019

Expedition 379: Amundsen Sea West Antarctic Ice Sheet History

Karsten Gohl and Julia Wellner

Expedition 382: Iceberg Alley and Subantarctic Ice and Ocean Dynamics

Mike Weber and Maureen Raymo

Expedition 383: Dynamics of Pacific Antarctic Circumpolar Current (DYNAPACC)

Frank Lamy and Gisela Winckler

JR100 (Expedition 379T): Extending high resolution paleoclimate records from the Chilean Margin to the Eemian

Samantha Bova and Yair Rosenthal

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

Beth Orcutt and Masako Tominaga

Executive Summary

The co-chief scientists of the JR expeditions in FY2019 reviewed the planning and operational procedures, laboratory equipment, and technical issues of the pre-expedition, expedition, and post-expedition phases. The JR has been operated as an outstanding scientific drilling platform managed by an extremely professional and skilled team of managers, engineers, technicians, and publication staff at JRSO. This drilling platform as well as the operational procedures are well managed and maintained, constantly improved, and provide a world-class infrastructure for ocean research. We thank NSF for providing this facility to address exciting science questions.

All expeditions, except 379 and 385T, achieved the majority of their scientific objectives. Expedition 379 suffered from an unusual sea ice and iceberg situation with no possibility to drill any sites on the continental shelf, which were the most important sites. This ice situation provided a challenge in ice management which was greatly mastered, resulting in two successfully drilled sites on the continental rise with continuous records. Expedition 385T did

not succeed to re-access the two holes for water sampling because the old inflatable packers could not be removed.

Most issues the co-chiefs identified in the pre-expedition and expeditions phases were relatively minor and included additional pre-expedition information and some technical problems in the labs and IT infrastructure of the JR. Most improvements we suggest are related to the post-expedition phase, in particular the preparation of a sample list and the organization of the sampling parties.

We very much appreciate that most recommendations of the past co-chief operations review reports have been implemented and hope that our recommendation in this report will also be considered and implemented.

We all see the necessity and benefit of the Co-Chief Review Meeting but recommend that this meeting could either partially or completely be held online with remote access to reduce travel costs and carbon emissions.

1) Introduction

As part of its annual review process, the *JOIDES Resolution* Science Operator (JRSO), together with NSF, regularly conducts post-cruise evaluations facilitated by the participation of the former expedition co-chiefs. This review summarizes the implementation, operation, and challenges of five recent expeditions (Expeditions 379, 382, 383, 385T, and JR100), all of which were completed during the past year (FY2019). A number of these legs were drilled in the high-latitude Southern Ocean and thus faced incredibly challenging conditions while at sea including sea ice, icebergs, high seas, and storms. The co-chiefs of these expeditions convened in College Station, in person or through video conferencing, from 24–25 February 2020 and reviewed expedition operations, issues, and accomplishments with input as needed from JRSO staff and leadership.

Below, we outline our recommendations ranging from pre-cruise permitting and staffing operations, to the operations on ship while at sea including labs and personnel, to post-cruise sampling and research. We hope our recommendations can lead to further improvements in an already outstanding scientific research program and feel privileged to have been part of such a dedicated and well-run organization.

2) Pre-expedition

2.1 Clearances and Permitting

Obtaining clearances for operations in territorial waters can be challenging. For most expeditions, all associated application processes went well without any delays or complaints. For Expeditions 383 and JR100, clearances turned out to be difficult due to a breakdown in communication between governmental authorities on the US and Chilean sides and requirements that were not properly communicated to JRSO. Clearances were given after a major delay, requiring a change of operational plan for Expedition 383.

Recommendation: Proactive planning and monitoring of the clearance procedures is required. Between the pre-cruise meeting and the start of the expedition, the Co-Chiefs should be provided with a regular (monthly or bimonthly) status report of the clearance/permitting status to allow for ample time to involve local collaborators if needed.

2.2 Staffing

The co-chiefs and staff scientists were provided with ranked and pre-selected lists from the PMOs. In general, we found the ranking very helpful, but there were cases in which the PMO pushed candidates due to member country quotas. ESSAC insists on a rather strict quota for individual countries so that less-qualified candidates for a specific task may have to be selected. PMOs of smaller member countries often only recommend one or two persons without alternatives. Lacking English language skills of some selected participants are another issue that has negative implications for communication, social interaction, and safety on board. The webinar is a good opportunity to inform potential applicants about the requirement of English language skills for expedition participants. For expeditions that are not open to the typical JRSO participant application process (like JR100/Exp. 385T), this should be made transparent and conveyed to the scientific community.

Recommendation: We recommend that PMOs show more flexibility in fulfilling their staffing quota, by integrating over longer time periods, e.g., over a year or two. The Co-Chiefs should have the option to communicate (e.g., via Skype/Zoom Interview) with potential participants to clarify any issues related to their applications, research interests, and/or test English language skills of candidates in doubt. This is expected to extend the diversity of participants by reducing the tendency to rely on "known quantities."

2.3 Communication

The pre-expedition communication was adequate and informative. All parties were well informed about the status of expedition planning, deadlines, and how to prepare. The pre-expedition meeting between Co-Chiefs and the JRSO staff at College Station is deemed to be helpful and essential for operational planning. There was consensus that the pre-expedition meeting needs to be held in person at JRSO, rather than virtually. In one case, there was a miscommunication between the science party and JRSO logistics, and a shipment with critical equipment was left at TAMU without the Co-Chief's knowledge. Sharing the TAMU shipping manifest with the Co-Chiefs would have prevented this problem.

Recommendation: We recommend that the bi-monthly status report shared with the Co-Chiefs (see 2.1) should include detailed information about the status of shipments of third-party equipment. We recommend to share with the Co-Chiefs a primer outlining the operational hierarchy, procedures, and communication paths, and the decision-making process on the JR.

This might help to better set expectations and reduce friction, particularly in the early stages of expeditions.

2.4 Planning related to Education and Outreach Activities

Most expeditions had largely positive experiences with selecting the E&O Officers. In one case, the pre-expedition planning related to E&O was problematic, as the Co-Chiefs were not involved in selecting the fairly large E&O contingent that took advantage of berths of opportunity.

3) Expedition

3.1 Ship and Navigational Procedures

All expeditions enjoyed the enormous experience and navigational skill of the bridge/ship crew. Ice management procedures were in place for Expeditions 379 and 382 to ensure safety of the ship. This includes frequent low- and high-resolution satellite data on sea ice coverage, weather forecasting, the observational skills of two professional ice observers, and a T-time calculation for abandoning drill hole. For Exp. 379, the calculated safety margins in the T-time calculation were over-exaggerated, leading of premature abandoning of some of the first holes. This was adjusted later during the expedition and worked perfectly during Exp. 382. High heave situations were handled properly with the right balance between pausing operations and expected core quality.

3.2 Drilling Capability and Tools

The drilling capabilities were sufficient for the objectives of the expeditions. The switch from APC/XCB to RCB coring requires tripping of the entire drill string, which is time-consuming. In some incidences, full APC coring could have been used further down in the hole, thereby avoiding early change to HLAPC, which slowed down the core recovery and produced more gaps in the record. For Exp. 379, a modified free-fall funnel/reentry system was developed that allowed reentry in soft surface sediments of the continental rise after a hole had to be abandoned due to iceberg approach. This system proved to be very successful, but only two of these systems were available. For Exp. 385T, pre-cruise engineering to design a system to latch on and remove the old wireline CORK platforms worked exceedingly well. However, old inflatable packers could not be removed from the holes and prevented the science party from achieving their objectives. It would be useful to get a JRSO feasibility analysis of whether or not it will be possible to open these holes in the future.

Recommendation: JRSO/IODP/NSF should invest in developing an integrated ACP/XCB/RCB coring system to avoid time-consuming tripping when changing to RCB. More of the modified reentry funnel systems should be made available for future expeditions to polar regions with sea-ice and iceberg occurrence.

3.3 Labs and Equipment

The labs are very well equipped and mostly up to date. The fast and successful implementation of X-ray imaging capacity is very much appreciated. It was extremely useful for initial scientific application (i.e., recognizing iceberg-rafted debris) for Exp. 379, 382, and 383. Once available it was also helpful to quickly identify the location for taking the volume-rich interstitial water samples on the whole core to avoid these samples taken from core material critical for other sampling. Once the cores were split, the X-ray images became critical tools for core description. Proposed plans to build and implement a new line-scan-based X-ray system with a moving X-ray source running along the core is highly appreciated and should have high priority.

We also appreciate the exchange of the color reflectance system with a newer system of higher spectral resolution. Still, we emphasize that the new system is much noisier compared to standard industry systems (e.g., from Minolta).

The NGR caused issues during Expeditions 379, 382, and to some extent during 383. A pause in use of NGR during Exp. 379 allowed collection of new background measurements and some trials, including running sections backwards, to test systematic errors. A new calibration with new background reduced the problem, although it was never entirely removed and remains in the data set. Exp. 382 reported problems with the individual sensors of the NGR. Despite numerous tests, there was no conclusive result as to the source of the problem. Some of the sensors seem to have behaved erratically.

The PMAG instrument caused power failures during Exp. 382 and 383, but with the great help of the technicians these could be fixed. The software used for the paleomag instrumentation (Live) works well as a visualization tool, but should be developed into a functional database to explore, filter and process the data.

Users of the ICP-OES instrument in the Chemistry Lab would benefit from improved documentation of methods and data reduction, including long-term standard runs for the ICP-OES instrument and some form of training for the participating scientists at the beginning of the expedition.

Recommendation: Build and implement the new X-ray system and improve the software to run the PMAG instrument.

3.4 Technical Support

The technical support from the IODP staff during all expeditions was absolutely outstanding. The techs were well-trained and helped the scientists around the clock.

3.5 Curation, IT, Software, Databases

In general, the IT infrastructure onboard is appropriate and sufficient. The upgrade with new, large screens in most labs was very much appreciated. Some of the computer hardware should be upgraded. Especially the Mac hardware seemed either outdated or simply not powerful enough. Also, the servers provided only little storage space. DescLogik needs to be integrated into LIMS to allow complete linkage of all data. The information by JRSO that a new integrated software is currently in development is very much appreciated. The implementation of an internet-independent communication chat app for smartphones (similar to WhatsApp) would be desirable for improved communication among scientists and staff on board.

Recommendation: Computer hardware and storage space should be upgraded. Adaptation of a communication chat app for smart phones would improve communication on board.

3.6 Outreach and Education

The participation of E&O officers was overall very much appreciated. Most E&O officers interacted with the scientists and produced their products according to expectations. Although we recognize that USSAC [USSSP?], and not the JRSO, are responsible for executing the E&O program, we recommend having two E&O officers on expeditions to increase interaction with public media, press offices, school science programs, etc. In addition, we agree that there should be more focus on selecting officers with interest, connection, and skills to interact with public/mass media rather than school and museum programs.

The use of social media platforms has greatly enhanced the visibility of science and operations conducted on the JR, but has also led to widespread distribution of sensitive information and/or images without explicit permission from the science party and co-chief scientists.

Recommendation: The E&O program can be most effective if officers are selected who have a connection to the science goals of the expedition. Co-chief scientists should be part of the approval process for photos and videos going off the ship, if they wish to be involved.

3.7 Communication

The communication between JRSO staff, drill crew, ship crew, and scientists was generally very good. The strict hierarchical order in the decision-making process for ship and drill operations was occasionally a matter of discontent for more experienced chief scientists of regular research vessels, but this can be avoided by clear pre-expedition information on such communication paths. We note positively that the Code of Conduct policy was strictly enforced.

Recommendation: A document explicitly outlining the decision making and operational hierarchy on the JR should be provided to co-chief scientists (see 2.3).

4) Post-expedition & General Issues

4.1 Sampling Party

The preparations for the sampling parties were quite different among the expeditions. Some were excellently organized with an almost complete sample plan right after the expedition, while others required a lot of extra time to complete the sample lists between the expeditions and the sampling meetings. In particular, those sampling parties that had to deal with a very large number of requested samples had trouble fitting their sampling plan into the given schedule. Also, planning for the creation of a ‘permanent archive’ should occur ahead of the sampling party to preserve as much core material as possible. Preserving an archive half, ideally from one hole per site or, for a spliced record, along the splice, should always be a priority. Although we had a difference of opinion on how flexible this policy should be, we agree that clear guidelines are needed for the program and should be a topic of future discussions.

Recommendation: The sampling party preparations should be improved and optimized, which includes organization of the repositories and development of guidelines for staff scientists, repositories and scientists. SPLAT is a useful sample organization tool and should be implemented on all IODP platforms and in all repositories.

XRF scanning prior to the sampling meeting has proven to be a very useful tool for refining the splice and for subsequent sample selection. Even though the XRF scanning is much appreciated, few expeditions have managed to successfully complete scanning prior to the sampling party. The scanning facility at the JRSO is well equipped. The major challenge has been organizing students, supervisors, and funding for the 2-month time slot for each expedition.

Recommendation: Regarding XRF scanning, the two-month window for scheduling scanning needs to be better communicated to the co-chief scientists or adjusted to the actual need, e.g., by dedicating XRF-scanning time to either a sample party or editorial meeting to reduce traveling. Organization of XRF scanning should commence during the expedition. Funding XRF scanning should be reconsidered by IODP funding organizations. We suggest considering several options for XRF scanning, ranging from purely science party-based options to hybrid models involving TAMU undergraduate students under JRSO/EPM supervision, in close correspondence with Co-Chiefs or other scientists from the expeditions. We recommend a community workshop to clarify the community’s needs and implementation of XRF scanning procedures and identify necessary resources.

4.2 Publications

The preparations for publishing the *Scientific Prospectus, Preliminary Report* and *Proceedings* volume were handled very efficiently and professionally by the JRSO Publication Group.

4.3 Communication

All communication between JRSO and the offshore/onshore science teams has been fantastic.