2021 Co-Chief Review of FY 2020 Operations

Expeditions (FY20)

Expedition 385: Guaymas Basin Tectonics and Biosphere

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Expedition 378: South Pacific Paleogene Climate

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Executive Summary

The *JOIDES Resolution* (JR) is an extraordinary science facility that has advanced discovery and understanding of all aspects of the Earth system. The experience of sailing on an International Ocean Discovery Program (IODP) expedition as a scientist is fulfilling, affirmational, and wondrous. The facility is remarkable not only for its capabilities, but also for the philosophy, borne out of an abiding value for scientific discovery, of constantly expanding and improving all aspects of the facility's operation. We commend the *JOIDES Resolution* Science Operator (JRSO) for engendering and supporting this ethic.

FY2020 operations of the JR were, like many other things, substantially impacted by the global COVID-19 pandemic. Only two expeditions sailed, Expedition 385 to Guaymas Basin, and Expedition 378 to the South Pacific. These two expeditions had remarkably contrasting operational experiences, but the Co-Chief Scientists are unanimously positive about those experiences and the operation of the facility. We summarize those experiences here, provide some suggestions for further improvement of the facility, and comment on the effectiveness and value of telepresence tools used to mitigate restrictions imposed by the pandemic.

1) Introduction

As part of its annual review process, the *JOIDES Resolution* Science Operator (JRSO), together with NSF, regularly conducts postcruise evaluations facilitated by participation of the former expedition Co-Chief Scientists. This review summarizes the implementation, operation, and challenges of the two expeditions conducted in fiscal year 2020.

Expedition 385 was conducted from 16 September–16 November 2019, with relatively short transits from San Diego, California (USA), to Guaymas Basin, in the Gulf of California, and back again to San Diego. The expedition was fantastically successful, with 8 sites occupied, multiple holes (as many as 5) drilled at each site, and more than 4 km of core recovered. The pace and work load were intense, but weather was pleasant and calm. There were two operational problems on this expedition that, in effect, canceled each other out. The first was a failed O-ring in the nitrogen line that necessitated redrilling a number of holes, and the second was unstable shallow sands in our deepest-target sites, which by abandoning them enabled us to comfortably recore the previous sites.

Expedition 378 was conducted from 3 January–6 February 2020, but it was preceded by some bad news. Testing and evaluation of the *JOIDES Resolution* derrick in the weeks preceding the already postponed expedition determined that it was not rated to safely support deployment of drill strings in excess of 2 km to the South Pacific, so only 1 of the 7 planned sites could be drilled, and the expedition was substantially shortened. Transit from Lauoka, Fiji, to the cored site south of New Zealand spanned 35° of latitude, and the return transit was longer still, at more than 2500 nautical miles. Despite these hardships, the multiple-hole recovery of South Pacific sediments into the late Paleocene represents a tremendous success.

2) Pre-Expedition

2.1 Clearances and Permitting

Clearances and permitting were handled very well for both expeditions. Expedition 385 required extensive support and guidance from the JSRO to deal with complicated Mexican permitting and visa issues, and those were handled with creativity and professionalism. Clearances from the Environmental Protection and Safety Panel (EPSP) to drill deeper than the originally approved depth for Site U1553 added untold value to the scientific impact of Expedition 378. Similarly, clearances granted by EPSP during Expedition 385, including adjustments to site locations and depths, were key to the successes of that expedition.

2.2 Staffing

The staffing process for IODP expeditions can be challenging. It requires balancing member country quotas, the scientific qualifications of applicants, and an expedition's particular requirements and objectives. The staffing process is effective, but it could be improved. For both expeditions, the Co-Chiefs and Expedition Project Managers (EPMs) were provided with ranked and preselected lists of applicants from the program member offices (PMOs), as is the standard process. The rankings were helpful, but they were in some cases biased away from

candidates who the Co-Chiefs knew to be superior. Few or no alternates were recommended by PMOs of member countries with lower berth quotas. The process does not include a means to assess candidates' enthusiasm for the expedition or their communication skills. For Expedition 385, the objectives required a staffing roster that was out of the norm of typical IODP science parties, placing extra burden on work-intensive groups. Some issues related to workload and poor communication skills during Expedition 385 might have been avoided with a more thorough vetting process. No such issues arose during Expedition 378. We praise IODP's and NSF's determined support for three Mexican shipboard scientists and a Mexican (US-based) outreach officer for Expedition 385, which was also a departure from standard staffing. Substantive Mexican participation made a big difference for the Guaymas Basin expedition, which was favorably reported in Mexican news media.

Suggestions:

1) Preselection interviews with "shortlisted" applicants would go a long way toward gauging an applicant's suitability to their expected role, as the expectations for a particular position may vary from expedition to expedition.
2) PMOs should put forward more than 1–2 applicants to prevent situations where weak candidates have to be accepted for lack of alternatives.

2.3 Communication

Preexpedition communications have an exceptionally broad scope. The preexpedition meeting in College Station, Texas, with goals of engaging the Co-Chiefs and the JRSO staff, verifying expedition objectives and operations, educating the Co-Chiefs on details of those operations, and many other things, is particularly important, as many technical and engineering factors become effectively locked in at that meeting. It is critical that this meeting continue to be held in person if conditions permit.

The preexpedition communications for Expedition 378 were as timely and informative as possible given the unforeseen scheduling challenges associated with that leg. All parties were well informed about the status of expedition planning, deadlines, and how to prepare. Precruise communications were similarly effective for Expedition 385, as the excellent outcomes of that expedition attest. Nevertheless, issues that arose during that expedition prompt two suggestions. One issue is related to casing. We noted at the precruise meeting that two sites were likely to have problems with sand shallow in the hole, and we left the precruise meeting with the impression that casing could be used to mitigate this problem if it arose. When we eventually encountered those sands, we were informed that casing was a complex operation requiring extensive precruise planning and that no casing was aboard the ship. Those

holes were consequently abandoned early. The second issue relates to interpersonal tensions that developed during the expedition. The sources of the tensions were complex, but each instance had a component of intershift factionalism that may relate in some part to the distinct working environment of the JR. Co-Chiefs regularly engaging in crossover lab meetings of all the groups (as done successfully for the Microbiology group) may have helped to capture or avoid those problems.

Suggestions:

1) Drilling plans for holes with contingent operations (e.g., mitigating stability or overpressure, addressing hydrocarbon risks, etc.) should be specified in detail at the precruise meeting.
2) Co-Chiefs should be reminded that the JR working environment is in many ways different from other oceanographic cruises. As with harassment issues, Co-Chiefs should be encouraged to remind the science party of the tendency for friction to develop at sea and encourage them to actively identify and resolve conflicts at daily crossover meetings; and Co-Chiefs should be encouraged to rotate through the crossover meetings of all the lab groups.

2.4 Planning related to Education and Outreach Activities

Planning and staffing for E&O activities was handled well for both expeditions. For Expedition 378, delay in expedition operations required that the original US E&O staff member be replaced, but this resulted in an even stronger team member who provided critical cohesion for the E&O cohort. For Expedition 385, science staffing requirements left only one berth available for an E&O officer, and telepresence interviews of candidates enabled us to identify a candidate who was willing and able to serve in this singular role. Our officer excelled in this role, becoming integrated with the science party in a way a larger E&O cohort might not have been.

3) Expedition

The 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 for the expeditions were efficient and effective. We are all very grateful to have had the opportunity to participate in this exceptional international program.

3.1 Communication

The communication between JRSO staff (ship and shore), drill crew, ship crew, and scientists was very good at all times, which is a remarkable thing.

3.2 Drilling Capability and Tools (including Logging)

The drilling operations for the two FY2020 expeditions differed substantially, but they were both very successful and made use of the range of drilling and logging capabilities.

Operations for Expedition 378 were limited predominantly by the condition of the JR derrick. Testing and evaluation of the derrick in the weeks preceding the postponed expedition determined that it could not be rated to safely support deployment of drill strings in excess of 2 km length; and so only 1 of 7 sites could be drilled. Otherwise, Expedition 378 exploited the full range of drilling capabilities, including the half-length advanced piston corer (HLAPC), in order to recover the most complete section possible. The only mechanical/technical challenge was an issue with the top-drive motor that required ~12 hours to repair.

Operations for Expedition 385, in contrast, were continuous and intense, with exceptional execution, attention to safety, and superb communication. We recovered a tremendous amount of core, using every available coring tool, and logged three holes. HLAPC coring substantially extended the depth range for recovering uncontaminated sediments for pore water geochemistry and microbiology, and artful hard-rock rotary core barrel (RCB) drilling through the 70+ m thick sill in Hole U1546C provided a stunningly continuous core. Logging tools performed as expected and provided data central to our objectives. We also made numerous *in situ* formation temperature measurements that were also central to our objectives. The on-board efforts to extend the temperature range of these tools were truly commendable.

3.3 Laboratories and Equipment

The labs and instrumentation functioned very well on both expeditions, with only a few periods of brief down time to recalibrate or troubleshoot, which is expected of continuously operating instruments. The labs and equipment, including layout, lighting, and cleanliness, are much improved relative to the past experience of at least one Co-Chief, and the operational ethic is one of continuous improvement.

The major equipment-related event of Expedition 385 was certainly the discovery, three quarters through the cruise, that the laboratory nitrogen supply contained oxygen in almost atmospheric concentrations; a defective O-ring at the gas intake was identified as the culprit. Since the nitrogen gas supply was rarely used on previous cruises to the extent as on Expedition 385, the lines and supply had not been monitored and checked on a regular basis. The microbiology and biogeochemistry science teams had not imagined the possibility of such a complete failure, since in everyone's home laboratory the nitrogen gas supply is as fundamental as water or electricity. The blanket recommendation/reminder here is that

absolutely nothing should be taken for granted, and that *regular pre- and syn-cruise checks of essential lab functions are critical*.

3.4 Technical Support

For each expedition, the shipboard technical team was brilliant, professional, and an absolute joy to sail with. On Expedition 385, where the workload was genuinely grueling, this team maintained both very high standards and an upbeat and supportive spirit, and substantial credit for this performance goes to the exceptional leadership of the team. As long as IODP has technical support of this quality the program will be doing just fine.

3.5 Curation, IT, Software, Databases

These systems are highly evolved and also evolving. Importantly, the shipboard staff is fully knowledgeable of the practices and protocols surrounding curation and documentation of samples and data, and they firmly enforce those protocols. The curation teams on both expeditions served brilliantly and professionally.

On Expedition 385, there were new types of samples, sampling, and measurements for which established procedures did not exist, and this created confusion and tension initially. The "new" type of samples included hard-rock pieces that needed to be quickly isolated from oxygen ("bagged") and subsampled for microbial assays. The new type of measurements involved gases exsolved from "bagged" hard-rock samples. A curation protocol for "bagged" hard-rock samples was developed relatively quickly, but a documentation protocol for measurements made on the exsolved gases was never fully developed by the scientists, and this contributed to considerable tension. The hard-rock case should have been anticipated by the Co-Chiefs and others, but the gas case was unexpected. Managing and preventing protocol uncertainty is likely to minimize tensions by clearly delineating sample processing and curation responsibilities.

Suggestions:

1) We recommend naming data files, including core images, starting with the IODP ID, rather than a database number, in order to make it easier to find a given core image or data file.
2) A "protocol for the development of protocols" should be put in place in anticipation of new types of samples and measurements that may unexpectedly arise during an expedition.
3) A technical note for measurement of exsolved gases in rock samples, and matching curation guidelines, should be put in place.

3.6 Outreach & Education

The E&O efforts of the two FY2020 expeditions differed, in that Expedition 385 sailed with only a single E&O officer, whereas Expedition 378 had a more typical E&O team. All Co-Chiefs were happy with the E&O components of their expeditions.

Expedition 378 had a marvelous and highly competent E&O team that thoroughly immersed themselves in the science and operations of Expedition 378. They complemented and supported each other as well as the shipboard party. The Chinese E&O representative turned his efforts to helping the New Zealand and US representatives when the COVID-19 outbreak shut down Chinese activities.

Expedition 385's outreach officer was very active. He organized online classroom events, virtual tours of the JR, online science chats with various shipboard scientists, Facebook live broadcasts, and lively cruise blogs that provided insight into shipboard life and science, often written by the shipboard scientists themselves. The science crew participated with gusto and engaged their audiences in English, Spanish, French, and Japanese. He also contributed to shipboard morale by designing "Lord of the Ringvent" movie posters that featured the shipboard scientists in various iconic roles of the trilogy. The entire experience was very positive and shows the value of choosing an energetic and enterprising outreach officer.

Suggestion:

The Expedition kick-off symposium at Scripps Institution was well received and enthusiastically attended. Meeting the Co-Chiefs of DSDP Leg 64 on this occasion was a great experience that reminded everyone of the long-term, multigenerational continuity of ocean drilling. People are into this for a lifetime, and the IODP community continues to be welcoming and inclusive. The Scripps symposium was inspired by the JR's return to a US port, but similar events could be organized in other ports as with great benefit.

3.7 Ship and Navigational Procedures (including Safety)

Ship, navigational, and safety procedures were mostly excellent for both expeditions. However, bad fuel taken on in San Diego prior to Expedition 378 sailing rapidly drew down the ship's reserves of fuel filters. Precious operating days were saved by switching fuel tanks to use fuel sourced during another port call. The switching of tanks and also the resupply of fuel filters (which enabled completing the final transit at the cost of ~12 operation hours) are examples of quality operations decisions and procedures. If routine fuel testing is at all practical, it should be incorporated as a standard procedure.

For Expedition 385, precise navigation, including the use of real-time seafloor video for positioning, contributed greatly to the success of the expedition, the safety of seafloor fauna, and enabled verification that sites were left safely and uncontaminated by our operations.

We also note here that the efficient and friendly housekeeping and galley staff kept us civilized and well fed. The culinary events (themed dinners, lava cake) and the Sunday barbeques supported morale and added a touch of civilized refinement that was really appreciated.

4) Post Expedition

Postexpedition activities were dramatically impacted by the COVID-19 pandemic. The sampling and postcruise report-writing meetings of both expeditions were canceled. These cancelations revealed the dedication of the EPMs and Gulf Coast Repository (GCR) staff, which is outstanding, and the utility of teleconferencing and remote editing, which are very useful but also limited.

4.1 Sampling Meeting

Postcruise sampling and X-ray fluorescence (XRF) scanning was performed by the EPMs of the two expeditions, small contingents of GCR staff and, for Expedition 385, a TAMU-based member of the science party. Sampling for Expedition 385 was completed prior to the GCR labs fully shutting down. This was a truly admirable effort for which we are deeply grateful. Expedition 378 sampling and XRF scanning were delayed by the lab closures and then, as for Expedition 385, those tasks were performed by JRSO curation staff, the expedition EPM, and other GCR staff. Again, deep gratitude goes out to those dedicated folks.

4.2 Publications (before, during, and after the expedition)

The Publications team at the JRSO provided excellent support before, during, and after the two FY2020 expeditions. Expedition 385 had a substantial shipboard writing effort running continuously for nearly the entire expedition, coincident with seemingly nonstop core recovery. The EPM provided primary leadership for that effort and did an outstanding job.

The postcruise in-person editorial meetings in College Station fell victim to the COVID-19 pandemic. The Publications team at JRSO facilitated remote editing using online tools. They did a great job at this, and it's unlikely those tools could be much improved. Nevertheless, the process was only adequate. It has the advantage of high flexibility for when to work on text, figures, and files, but the disadvantages are substantial. Actual discussions of edits were rare, with "discussion" taking place mostly via comments left in online documents, and there was very little scientific discussion of results and, consequently, little opportunity for any creative spark to ignite. Similarly, and perhaps worse, there was no real opportunity for interdisciplinary discussion, as the process was structured to focus individually on disciplinary chapters. In addition, the process of remote online editing is slow, which provides a disincentive to spend

time organizing more engaging group meetings across times zones, effectively creating negative feedback on creativity. We strongly urge the JRSO to return to face-to-face editorial meeting in the future when conditions allow.