

# **IODP Operations Review Task Force Meeting**

Expedition 327  
Juan de Fuca  
Hydrogeology

December 12<sup>th</sup> – 13<sup>st</sup>, 2011  
TAMU, College Station  
TX, USA

## EXPEDITION 327 OPERATIONS REVIEW TASK FORCE (ORTF)

### PARTICIPANTS

|                     |   |
|---------------------|---|
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| Takeshi Tsuji       | Co-Chief Scientist, Kyoto University, Japan                   |
| David Garrett       | External Reviewer, Stress Engineering, USA                    |
| Eiichiro Araki      | External Reviewer, JAMSTEC IFREE, Japan                       |
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## **MEETING FORMAT**

The IODP-MI Operations Review Task Force (ORTF) met on December 12<sup>th</sup> - 13<sup>th</sup> at the Texas A&M University (TAMU), College Station (USA) to review the operational aspects of Integrated Ocean Drilling Program (IODP) Expedition 327 Juan de Fuca Hydrogeology. The review concentrated on “lessons learned” from the expedition with an emphasis on “what should be done differently in the future.” ORTF review was based upon confidential reports submitted by the U.S. Implementing Organization (USIO) and the Expedition 327 Co-Chief Scientists, as well as on expedition daily and weekly reports available on-line.

The meeting began with oral presentations by the Co-Chief Scientist (Andrew Fisher and Takeshi Tsuji) and the Expedition Project Manager (EPM: Katerina Petronotis), summarizing the Co-Chief Scientists’ and USIO reports, respectively. The Co-Chief Scientist also presented Co-chiefs’ joint recommendations. Following the presentations, External Reviewers and IODP-MI personnel had an Executive Session to identify primary-level issues and secondly-level issues on this expedition for the discussion and to formulate a number of draft recommendations. On the second day of the meeting, ORTF reviewed the draft recommendations from the Executive Session and finalized them. These recommendations are presented in this report.

## **EXPEDITION SUMMARY**

Expedition 327: July 5<sup>th</sup> – September 5<sup>th</sup>, 2010

*Co-Chief Scientists: Andrew Fisher, Takeshi Tsuji*

*Expedition Project Managers: Katerina Petronotis*

*USIO Operations Superintendent (OSI): Michael Storms*

IODP Expedition 327 “Juan de Fuca Hydrogeology” and related experiments (APL-762) focused on understanding fluid–rock interactions in young, upper ocean crust on the eastern flank of the Juan de Fuca Ridge, delineating the magnitude and distribution of hydrologic properties; the extent to which crustal compartments are connected or isolated (laterally and with depth); the rates and spatial extent of ridge–flank fluid circulation; and links between ridge–flank circulation, crustal alteration, and geomicrobial processes. Expedition 327 built on the achievements of IODP Expedition 301 and subsequent submersible and remotely operated vehicle (ROV) expeditions. Both drilling expeditions installed seafloor borehole observatories (“CORKs”) in basement holes to allow borehole conditions to recover to a more natural state after the dissipation of disturbances caused by drilling, casing, and other operations; provide a long-term monitoring and sampling presence for determining fluid pressure, temperature, composition, and microbiology; and facilitate the completion of active experiments to resolve crustal hydrogeologic conditions and processes.

During Expedition 327, two basement holes were cored and drilled at Site U1362. Hole U1362A was cored and drilled to 528 mbsf, subjected to geophysical logging and hydrologic testing, and instrumented with a multilevel CORK observatory. Hole U1362B

was drilled to 359 mbsf, subjected to a 24 hour pumping and tracer injection experiment, and instrumented with a single-level CORK observatory. Both CORK observatories include monitoring of pressure and temperature and downhole fluid and microbiology sampling. Wellhead samplers were added and a long-term cross-hole test was initiated during a post drilling ROV expedition in summer 2011. In addition, part of an instrument string deployed in Hole U1301B during Expedition 301 was recovered during Expedition 327, and a replacement string of thermal sensors was installed. Finally, a program of shallow sediment coring was completed adjacent to Grizzly Bare outcrop, a suspected site of regional hydrothermal recharge. Thermal measurements and analyses of pore fluid and microbiological samples from a series of holes aligned radially from the outcrop edge will elucidate rates of fluid transport and evolution during the initial stages of ridge-flank hydrothermal circulation.

See [http://iodp.tamu.edu/scienceops/expeditions/juan\\_de\\_fuca.html](http://iodp.tamu.edu/scienceops/expeditions/juan_de_fuca.html) for more details regarding the background and objectives, the preliminary scientific results, and conclusions of Expedition 327.

#### **RECOMMENDATIONS OF THE EXPEDITION 327 ORTF**

Expedition 327 ORTF found that the Juan de Fuca Hydrogeology was one of the most technically challenging expeditions mounted by USIO during IODP and was largely successful. This success resulted from a combination of factors including the refurbishment of the *JOIDES Resolution* and its equipment, close collaboration and communication between science party and operators, and professionalism, willingness and the concerted effort shown by all parties to work through issues as they arose at sea and onshore.

In Particular, two CORK observatories were successfully installed during Expedition 327. Together with the existing CORK observatories, which were installed during Expedition 301 in 2005 and on ODP Leg 168 in 1996, the experiment to conduct long-term cross-hole hydrologic experiments at crustal scales is now underway. It is the first experiment of this kind in ocean drilling science history. All parties involved in deployment of CORK observatories at Site U1362 are to be congratulated.

ORTF also identified several areas for future *JOIDES Resolution* operational improvement, particularly pre-expedition planning/preparation and during-expedition operations. Specifically, ORTF identified that issues related on CORK retrieval operation on Expedition 327 had been not fully recognized by USIO during expedition preparation. ORTF recognized it is because lack of project management on focusing expedition issues by USIO. ORTF Expedition 327 has made eight recommendations for primary issues and another eight ones for secondary issues that are being addressed by the USIO. While the primary focus of this review was on USIO operations during Expedition 327, many recommendations in this report are equally valuable for other IODP operators, IODP management, IODP scientists and some recommendations are also directed to them.

## **Primary-Level Issues:**

### **Recommendation 327-01: Platform Scheduling**

ORTF Expedition 327 recommends that platform schedule should be finalized a minimum of 18 months in advance of the fiscal year that the expedition will be sailed.

Routing: IODP-MI, IOs, Lead Agencies

Background: Expedition 327 was scheduled in summer 2009, the call for applications was delayed, and review of applications could not begin until winter 2010. This was about 6 months prior to sailing. Also this less than a year lead time was very tight on CORK equipment preparation and caused some rush on scientists and USIO.

ORTF Expedition 327 suggests a minimum 18 months advance platform scheduling. Having expeditions scheduled farther in advance will allow better planning on expedition and more efficient preparation process, which may save the cost on preparation. As the result, the IO may be able to allocate more funds for scientific measurements/lab activities. Early expedition scheduling may also provide a better opportunity for science party to obtain external funding for CORK observatory and etc.

### **Recommendation 327-02: Interface Manager**

ORTF Expedition 327 recommends assigning an Interface Manager in the IO for each expedition with responsibility for assuring that all critical engineering-operational preparation tasks being undertaken and completed by the IO staff and by the Co-Chiefs/Science party. This person should have project management experience and will act as the primary interface with Co-Chiefs/Science party. Roles and responsibilities for this position should be clearly defined by the IO.

Routing: IOs

Background: This is good project execution practice. One of the biggest challenges faced by Expedition 327 was the lack of identification of a single person who was in charge of operations, engineering planning and preparation. At various times during the expedition planning process, numerous individuals in USIO led various meetings and were assigned to complete several engineering-operational preparation tasks, yet there was no single point of contact or follow-up.

### **Recommendation 327-03: Quality Control Technician**

ORTF Expedition 327 recommends assigning a Quality Control Technician with drilling operations experience in IO, to verify preparation of tools, systems, sizes, etc. IO should develop roles and responsibilities for this position.

Routing: IOs

Background: Expedition 327 suffered with ill-preparedness of CORK observatory equipment and its operation. Several key tools which were required for this expedition were missing on the ship such as correct Hole 1027C CORK recovery tool, pup joints, correct diameter of swellable packer and etc, and the unavailability of key tools seriously affected the expedition results. The greatest disappointment was the inability to recover the CORK system from Hole 1027C.. Replacement of this CORK, after deepening Hole 1027C, was a high priority for Expedition 327. ORTF agreed that there has to be a support technician, who has been offshore, who knows what is critical to measure etc for technologically/operationally complex expedition such as Expedition 327. The vision of this recommendation is that Quality Control Technician is separated position from Interface Manager. A person assigned to this position should be who has real field experience on drilling rig operation such as rig foreman, but not have to be costly person (e.g., rig engineer). This position could be assigned to contract employee who already retired from field operation when it is necessary on expedition.

**Recommendation 327-04: CORK Recovery Study**

ORTF Expedition 327 recommends IODP-MI to develop a database of existing CORK installations (at ODP and IODP) and their current status, including evaluation of the need for CORK retrievals over the next 10 years, and determination of the feasibility retrieving the existing CORKs. This information will assist the IO to determine best procedure and best/suitable equipment to be used on CORK retrieve operation.

Routing: IODP-MI

Background: The USIO has attempted to retrieve three first-generation CORK observatory systems, one each during Expeditions 301 and 336 (both successful), and one during Expedition 327 (unsuccessful). It is important to try to determine the needs of retrieving or replacing previously deployed CORKs based on the current status of CORK. The design of future CORKs may need to be changed if there is anticipated interest in recovering these systems. It is difficult to predict how much interest there may be in the next decade in retrieving CORKs from ocean boreholes, but having this information available would be helpful with planning.

**Recommendation 327-05: Cementing Practice Study**

ORTF Expedition 327 recommends IODP-MI to collect the results of recent cementing operation from expeditions. IODP-MI needs to collect successes and failure cases of cementing with IOs's help/input and document them into such as Technote, and publish best practices among the IODP.

Routing: IODP-MI, IOs

Background: Cementing is one of critical operation to achieve successful science

of expedition and has been proven as problematic in past IODP expeditions.

At Expedition 301 in 2005, two CORKs were deployed to Hole U1301A and U1301B, but from later collected temperature data from both CORKs by ROV, PI found that both holes have leaking and were not fully sealed as intended after cementing at Expedition 301. Therefore another cementing operation for sealing both hole was conducted at Expedition 321T in 2009.

Expedition 327 recovered five of the autonomous temperature loggers of CORK from Hole U1301B and learned that thermal conditions in Hole U1301B are begin recovering toward natural conditions in Summer 2009, soon after cementing during Expedition 321T. This indicates that the cementing effort during Expedition 321T was successful in sealing the borehole after five years of cold bottom water flowing down the casing and into basement

Those retrieved temperature data at Expedition 327 indicated the success of cementing on Expedition 321T. And the data clearly showed how the cementing operation affects borehole temperature measurement. This was one of the few occasions to confirm cementing result on IODP expeditions.

#### **Recommendation 327-06: Fit Tests, Measurement Practices**

ORTF Expedition 327 recommends developing practices to ensure control of dimensions, and to ensure that parts fit together in the field. The IO should determine the dimensions including ID, OD, Drift, length, and weight of each component and conduct onshore integration tests (Site Integration Test [SIT]) to ensure on-field fit-up, including use of mock-ups and other means.

Routing: USIO, IOs

Background: Lack of conducting integration tests and confirming each CORK equipments dimension during expedition preparation by USIO and Co-Chiefs/Science party caused many problems at Expedition 327. For example; 1) The swellable packer elements had wrong diameter for fit to the existing/planned borehole and had to be modified; 2) CORK instrument string deployed in Hole U1362A was initially too long (attributed to the Spectra rope stretching more than expected) and the string had to be brought back to the rig floor, shortened, and redeployed.

#### **Recommendation 327-07: Contingency Planning**

ORTF Expedition 327 recommends that contingency plans for plausible scenarios should be included in the primary plan and clearance authorization obtained.

Routing: IOs, Co-Chiefs

Background: Expedition 327 spent nearly 60 hours at Hole 1027C to try to retrieve existing CORK (installed at ODP Leg 168 in 1996) from hole. Because the appropriate CORK recovery tool was not on the ship, *JOIDES Resolution* crew had to fabricate the required recovery tool using the existing tool and this fabrication

took 36 hours to complete.

In retrospect, it would have been wise to have a contingency hole for Hole 1027C. If there was contingency plan and preparation for Hole 1027C operation, Expedition 327 might have been drilled entire new hole at the same site and successfully installed third CORK.

**Recommendation 327-08: ORTF meetings**

ORTF Expedition 327 recommends scheduling ORTF meeting before Expedition sails and holding it within 3–6 months of end of expedition. The requirement should be specified in the Co-Chief contract.

Routing: IODP-MI

Background: IODP-MI held ORTF meeting for Expedition 327 after 18 months post-cruise. This delay is too long to discuss and respond to problems encountered during an expedition. ORTF should identify the issues and make recommendations while the issues on expedition are still in fresh.

**Secondary-Level Issues:**

ORTF Expedition 327 made following eight recommendations as secondly level issues because those issues have been already addressed by the USIO after Expedition 327.

**Recommendation 327-09: Hard Rock Core Description System**

ORTF Expedition 327 recommends USIO to stabilize hard rock core description system and applications.

Routing: USIO

Background: Several data entry systems caused problems during Expedition 327. The forms used for hard rock description software and database were notoriously unstable. On several occasions the petrologists had to re-enter information after losing hours of considerable work because of software crashes.

**Recommendation 327-10: P-wave Measurement System**

ORTF Expedition 327 recommends USIO to test and fix P-wave measurement system.

Routing: USIO

Background: The system used for determination of discrete P-wave velocity measurements was unreliable and produced considerable data of questionable quality at first half on Expedition 327. One issue involved the mechanical system

used to acquire the data, but there were also software problems with automated arrival picking.

Current P-wave measurement systems hardware and software components require updating, fixing, stabilizing, and need to provide standards with velocities similar to anticipated materials

**Recommendation 327-11: Thermal Conductivity System**

ORTF Expedition 327 recommends USIO to test and fix thermal conductivity systems.

Routing: USIO

Background: The system used for acquisition of thermal conductivity data in half-space mode was chronically unstable at Expedition 327. Scientists found that the system hardware/electronics combination returned inconsistent data. There is also a lack of calibration standards for this system. Thermal conductivity hard rock probe broke and spare probes were unavailable on ship because they had been sent to the vendor for repairs. In addition, the acquisition and processing software had been poorly crafted.

**Recommendation 327-12: Video Conferencing Capabilities**

ORTF Expedition 327 recommends USIO to update or supply supplemental video conferencing capabilities for education, outreach, and communications.

Routing: USIO

Background: Expedition 327 had an extensive outreach program include ship-to-shore video communication event. However, during this video communication event, limited band wide of *JOIDES Resolution's* internet connection often caused slow connection, garbled and disconnection.

**Recommendation 327-13: Seafloor Operations Recording**

ORTF Expedition 327 recommends USIO to record (video) and be stored all seafloor operations. USIO should make video records of seafloor data as prime data and post for use in an accessible format.

Routing: USIO, IODP-MI

Background: Expedition 327 had problem with collection of seafloor video records of re-entries and CORK operations. Scientists asked repeatedly to shipboard personnel that all seafloor operation activities be recorded and transferred to video files for use by them (including a formal request during at least one pre-cruise planning meeting). However, it turned out that most of the expedition video activities were not recorded because there was a fault in cabling to the DVD-R device.

**Recommendation 327-14: Drilled Intervals Numbering**

ORTF Expedition 327 recommends USIO to clarify and communicate conventions for numbering of drilled intervals.

Routing: USIO

Background: On Expedition 327, there was confusion over the conventions for numbering of drilled intervals. When the first core collected in Hole 1362A, at about 100 m into basement and 350 mbsf, was labeled as 6R. This number was assigned because multiple drilling operations that proceeded coring were themselves assigned individual "interval" numbers. Adding to the confusion, the only person onboard the vessel who understood the reason for this initial core number assignment was one of the operations superintendents who happened to be asleep at the time.

Overview of the drilled intervals numbering plan needs to be shared between operations personnel, Co-Chiefs, scientists, technicians and curator.

**Recommendation 327-15: Evaluation of Lab Space**

ORTF Expedition 327 recommends USIO to evaluate utilization of lab space, if there is any way to increase available space to do science.

Routing: USIO

Background: During Expedition 327, some laboratory areas were so jammed with equipment and had difficulty for scientists to find a place for general scientific work, computation, writing, etc. Especially on chemistry lab and physical properties work spaces.

**Recommendation 327-16: Rig Instrumentation System**

ORTF Expedition 327 recommends USIO to announce Rig Instrumentation System (RIS) data as prime data. USIO needs protocol and inform how these data will be accessed and archived. USIO should develop a file that describes what each track is and make clear at pre-expedition meeting that it is an option to have these data in real time on the platform (*JOIDES resolution*) and that scientist can select tracks to be dumped.

Routing: USIO

Background: The RIS worked well during Expedition 327. Shipboard engineering and technical staff helped to make sure that critical data was being logged to RIS when scientists needed.

However, RIS was not fully setup system for recording and archiving all kind of operation data and for provide it to scientist as prime data. Scientists had been given a small number of massive files containing many hours of RIS data, which is difficult to use. Therefore, scientists had to create programs to extract subsets of RIS data for use on particular projects.