

# **IODP Operations Review Task Force Meeting**

Expedition 332/333  
NanTroSEIZE Stage 2

August 18<sup>th</sup> – 19<sup>th</sup>, 2011  
Japan Agency for Marine-Earth  
Science and Technology (JAMSTEC),  
Tokyo

## **EXPEDITION 332/333 OPERATIONS REVIEW TASK FORCE (ORTF)**

### **PARTICIPANTS**

#### **Expedition 332/333 ORTF Meeting Members**

|                    |  |
|--------------------|--|
| Eiichiro Araki     | Exp.332 Co-chief, JAMSTEC, Japan   |
| Toshiya Kanamatsu  | Exp.333 Co-chief, JAMSTEC, Japan   |
| Pierre Henry       | Exp.333 Co-chief, CEREGE - College de France, France                                       |
| Dave Huey          | External reviewer, Stress Engineering Services .Inc, USA                                   |
| David Boutt        | External reviewer, University of Massachusetts-Amherst, USA                                |
| Ken Ikehara        | External reviewer, National Institute of Advanced Industrial Science and Technology, Japan |
| Tom Pettigrew      | External reviewer, Stress Engineering Services .Inc, USA                                   |
| Harold Tobin       | Co-chief Project Scientists, University of Wisconsin, USA                                  |
| Masa Kinoshita     | Co-chief Project Scientists, JAMSTEC, Japan  |
| Demian Saffer      | Specialty Coordinator, Pennsylvania State University, USA                                  |
| Gaku Kimura        | Specialty Coordinator, University of Tokyo, Japan  |
| Geoff Wheat        | Specialty Coordinator, University of Alaska Fairbanks, USA                                 |
| Mike Underwood     | Specialty Coordinator, University of Missouri, USA   |
| Wataru Azuma       | Center for Deep Earth Exploration, Japan   |
| Shomei Kobayashi   | Center for Deep Earth Exploration, Japan   |
| Daiji Ikenomoto    | Center for Deep Earth Exploration, Japan   |
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| Nori Kyo           | Center for Deep Earth Exploration, Japan   |
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| David Divins       | Consortium for Ocean Leadership, USA   |
| Mitch Malone       | U.S. Implementing Organization, USA  |
| Colin Graham       | ECORD Science Operator/British Geological Survey, UK                                       |
| Hiroaki Muraki     | Marine Works Japan.LTD, Japan  |
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| Tomoyuki Tanaka    | Marine Works Japan.LTD, Japan  |
| Issa Kagaya        | IODP-MI  |
| Kevin Johnson      | IODP-MI  |
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#### **Observers**

James Allan

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## **MEETING FORMAT**

The IODP-MI Operations Review Task Force (ORTF) met on August 18<sup>th</sup> - 19<sup>th</sup> at the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Tokyo to review the operational aspects of IODP Expedition 332 and 333 (NanTroSEIZE stage 2). 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 Center for Deep Earth Exploration (CDEX), the Expedition 332 & 333 Co-chief scientists, and NanTroSEIZE Specialty Coordinators.

The meeting began with oral presentations by Co-Chiefs Scientists of Expedition 333 (Toshiya Kanamatsu, Pierre Henry), Specialty Coordinators (Demian Saffer, Gaku Kimura, Geoff Wheat, Mike Underwood) and Expedition Project Managers (Sean Toczko, Moe Kyaw Thu) summarizing the Co-chief Scientists, Specialty Coordinators and CDEX reports respectively. Following the presentations, External Reviewers and IODP-MI personal had Executive Session to identified specific pre-expedition, expedition, and post-expedition phase topics for discussion and formulate a number of draft recommendations. On the second day of the meeting, Co-Chief Scientist of Expedition 332 (Eiichiro Araki) who attended the meeting from second day presented summary of Co-Chief Scientist report, then ORTF reviewed the draft recommendations from Executive Session and finalized it. These recommendations are presented in this report.

## **EXPEDITION SUMMARY**

Expedition 332 and 333 are part of the Nankai Trough Seismogenic Zone Experiment project. The Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) is a coordinated, multi-expedition drilling project designed to investigate fault mechanics and seismogenesis along subduction mega-thrusts through direct sampling, in situ measurements, and long-term monitoring in conjunction with allied laboratory and numerical modeling studies.

The fundamental scientific objectives of the NanTroSEIZE project include characterizing the nature of fault slip and strain accumulation, fault and wall rock composition, fault architecture, and state variables throughout the active plate boundary system.

### **Expedition 332: October 25th – December 11th, 2010**

Co-Chief Scientists: Achim Kopf, Eiichiro Araki

Expedition Project Manager: Sean Toczko

CDEX Operations Superintendents (OSI): Tomokazu Saruhashi, Ikuo Sawada

IODP Expedition 332 “Riserless Observatory” was a technically complex expedition targeting the shallow portion of C0002 for installation of the first permanent observatory in the NanTroSEIZE project. IODP Expedition 332 followed up, and expanded on, initial observatory operations begun during IODP Expedition 319 in 2009. The complexity of this expedition was mainly focused on engineering work, including (1) retrieval of a temporary observatory instrument (i.e. SmartPlug) installed during Expedition 319 at

IODP Site C0010, which penetrates the shallow “megasplay” fault in the midforearc; (2) deployment of an upgraded temporary observatory (i.e. GeniusPlug) at Site C0010; and (3) installation of a permanent observatory at IODP Site C0002 in the outer Kumano Basin, at the location of planned future deep riser drilling.

During the first few weeks, Expedition 332 focused on exchanging the SmartPlug temporary observatory with an upgraded GeniusPlug, both attached to a retrievable casing packer above the screened megasplay fault zone at Site C0010. The SmartPlug recovery was successful despite the strong Kuroshio Current, which can be attributed to an efficient reduction of vortex-induced vibration (VIV) on the drill string by attaching ropes. Times series data recovered from the self-contained instrument include seafloor and formation pressure as well as four independent temperature records from the fault zone and the overlying seafloor reference. Tentative analysis of the data proves the effective seal of the bridge plug; damped pressure amplitudes in the tight, slightly overpressured formation; and identification of prominent earthquake and tsunami events in the 15 month record (23 August 2009–7 November 2010). The SmartPlug was replaced with a GeniusPlug, which is similar in geometry and equally self-contained but with an addendum that hosts an OsmoSampler for collecting fluids for geochemical analysis and a flow-through osmotic colonization system for microbiological study. The system was installed at a depth that placed the addendum in the center of the 22 m wider screened cased section across the megasplay fault.

At Site C0002, somewhat upslope of Site C0010, a new hole was drilled with logging while drilling (LWD) and cased for placement of a long-term borehole monitoring system (LTBMS). The LTBMS is comprised of a CORK assembly with a hydrogeological unit measuring pressure at four depth levels as well as a broadband seismometer, volumetric strainmeter, tiltmeter, geophones, and a thermistor string. The key goals include pore pressure monitoring in the upper accretionary prism a series of measurements in the homogeneous sediments (strain, tilt, seismicity, and pressure) in the transition zone, and temperature and pressure monitoring in the overlying Kumano Basin sediments. The lower portion of the assembly is isolated from the overlying ocean by a swellable packer. Part of the instrument string below was cemented to couple the strainmeter and seismometer to the formation/casing. The electronic data cables and sensors on the LTBMS head were extensively tested using the remotely operated vehicle before and after cementing, and all were successful. The LTBMS will be connected to the Dense Oceanfloor Network System for Earthquakes and Tsunamis (DONET) real-time seafloor cabled network in Fall 2011.

See <http://www.jamstec.go.jp/chikyu/eng/Expedition/NantroSEIZE/exp332.html> for more details regarding the background and objectives, the preliminary scientific results, and conclusions of Expedition 332.

**Expedition 333:** December 12th, 2010 – January 10th, 2011

Co-Chief Scientists: Pierre Henry, Toshiya Kanamatsu

Expedition Project Managers: Moe Kyaw Thu

CDEX Operations Superintendent (OSI): Tomokazu Saruhashi, Ikuo Sawada

IODP Expedition 333 was carried out in the Kumano Basin, off the coast of Kii Peninsula as the continuation of the Expedition 332. The expedition involves drilling and coring of subduction inputs and heat flow measurements to better understand geophysical properties driving large subduction earthquakes at the margin of the Philippine Sea Plate which slides beneath the Eurasian Plate. In addition, drilling, coring and temperature measurements were made at the Site C0018 to understand the relationship between earthquake occurrence and submarine landslides as part of the Ancillary Project Letter (738-APL: Nankai Trough Submarine Landslide History [NanTroSLIDE]).

Expedition 333 started off its operations with drilling and coring at Site C0018 (water depth: 3084.35 meters) to a depth of 314.2 mbsf. These sediments are believed to be transported in response to submarine landslides. The drilling penetrated six layers of submarine landslide deposits known as mass transport deposits (MTD), with the lowest layer with 62 meters thickness. Immediately above and below this thick layer were deposits of volcanic ash commonly found around Japan. The age analysis of the upper ash indicates that the landslide causing this thick sedimentation probably has occurred about one million years ago.

In an attempt to explore the initial state of subduction inputs, drilling and coring was made at Site C0011 (water depth: 4050.5 m) and Site C0012 (water depth: 3510.5 m) in Shikoku Basin, an outer region of the Nankai Trough. Drilling was performed down to a depth of 380 mbsf at C0011 and 180 mbsf at C0012 for the sediments. In addition, coring continued underlying basaltic basement at C0012 to a depth of 630.5 mbsf. Stable and continuous drilling allowed recovery of cores in good condition, which permits analyses of stratigraphic sequence. Formation temperature measurements were made at all sites with APCT3 during piston coring in high-resolution. The results revealed a higher heat flow at C0012 than that at C0011, providing valuable clues to understanding the fluid circulation at input sites.

See <http://www.jamstec.go.jp/chikyu/eng/Expedition/NantroSEIZE/exp333.html> for more details regarding the background and objectives, the preliminary scientific results, and conclusions of Expedition 333.

## **RECOMMENDATIONS OF THE EXPEDITION 332/333 ORTF**

Overall, the Expedition 332/333 ORTF found that the both NanTroSEIZE Stage 2 Expedition 332 and 333 were successes. This success resulted from a combination of factors including, “Lessons Learned” from the previous expeditions, experience gained by CDEX working in the “IODP” environment, close collaboration between the Co-chief scientists and operators, and a professionalism, willingness and hard-work shown by all parties to work through issues as they arose at sea and onshore. All parties involved in these operations are to be congratulated on successful expeditions.

In particular, the Science Party and the ship operator successfully conducted deploying

several bore hole monitoring instruments as in the following Acknowledgements 332/333-01 to 03, which ORTF believes future provide data from the monitoring instruments will produce a wealth of scientific knowledge in the years to come.

**Acknowledgement 332/333-01: SMART and GENIUS Plug Deployments**

ORTF Exp.332/333 acknowledges CDEX for the first successful recovery and deployment of the temporary observatories (i.e. the SMART and GENIUS plugs) during Expedition 332, providing a means for the successful recovery of important borehole data for the science community.

**Acknowledgement 332/333-02: LTBMS Installation**

ORTF Exp.332/333 acknowledges CDEX for the successful deployment of the LTBMS during Expedition 332. The LTBMS was a very complex undertaking, which was carried out smoothly with all indications that the instruments are working properly. Once connected to the DONET network, the LTBMS will provide the science community with valuable borehole data for years to come. A job well done.

**Acknowledgement 332/333-03: VIV Control**

ORTF Exp.332/333 acknowledges CDEX for its innovative means of controlling VIV by attaching ropes to the drill string in the area of high currents. This is a prime example of technology that can be transferred to the USIO to improve IODP operations overall.

ORTF also identified a few areas of improvement for future *Chikyu* operations including: pre-expedition planning/preparations, during-expedition operations, and engineering.

Many of the issues discussed during this review were related to enhancement of *Chikyu*'s operational/technical capabilities and communication/information sharing. Specifically, the ORTF identified/expressed the importance of communication between Co-chiefs, Specialty Coordinators, Science Party and Implementing Organization Management during the expedition planning phase to enhance efficient operations and successfully achieve the expedition goals. To help simplify solutions to these issues, the ORTF made specific recommendations as related to specific situations.

While the primary focus of this review was on CDEX operations during Expedition 332 & 333, many recommendations in this report are equally valuable for other IODP operators and Project Management Team (PMT). As such, some recommendations are also directed to these entities.

**Pre-Expedition**

**Recommendation 332/333-01: Lead time to enhance scientific staffing**

ORTF Exp.332/333 recommends an increase in the amount of time between call for scientific staffing and the expedition start. Consider making available a document that describes future NanTroSEIZE plans including details regarding plans and goals of expeditions.

**Routing:** NanTroSEIZE PMT, CDEX

**Background:** Short staffing lead times continue to plague NanTroSEIZE and is impacting the ability of the project to maintain high-quality research and science products. The ORTF's opinion is that the image of the project suffers as a result of cancellation/postponement of proposed expeditions, rushed staffing decisions, and unavailability of experienced scientific personnel making it difficult to recruit the most-desired scientists. ALL efforts need to be taken to increase the lead time between calls and cruise dates. To provide forewarning and guidance to the potential applicant pool it is recommended that the NanTroSEIZE Project Management Team (PMT) provide a short, publically-available document that describes the NanTroSEIZE long term plans (including brief summaries of previous expeditions and results) with potential scheduling, timing, scientific goals, and staffing needs, including expectations of the scientific party regarding the amount and nature of engineering versus scientific operations. The concept of a mini-prospectus provided in advance of the official call for applications is considered to be a good idea. In the light of short-lead times the community deserves to have some idea of what the plans are. The document should be considered a living document and will be updated as plans evolve.

**Recommendation 332/333-02: Improve communication avenues between specialty coordinators, co-chiefs, and scientists**

ORTF Exp.332/333 recommends that greater efforts be made in the development, documentation, and enforcement of standard operating procedures for and between the specialty coordinators, co-chiefs, science party, and expedition project managers.

**Routing:** CDEX

**Background:** The ORTF applauds the specialty coordinator system and the efforts of the team members. This team provides the overall guidance and structure that enables disparate science parties and expeditions to reach the overarching goals of the NanTroSEIZE project. As more expeditions are undertaken, this role becomes increasingly important and more difficult to manage. It is recommended that a standard operating procedure regarding the proper and timely communication of science parties with the specialty coordinators (as administered by the co-chiefs and expedition projects manager) be developed. All efforts should be made by the specialty coordinators in attending the pre-cruise briefing (maybe even by video-conference if possible) to help describe expedition expectations and communication procedures.

**Recommendation 332/333-03: Scientific staffing methods**

ORTF Exp.332/333 recommends CDEX to take special effort to find scientific experts for critical scientific needs of the expedition. When conventional scientific expertise is not available by normal staffing methods, CDEX need to consider

alternate methods (e.g., for biostratigraphy, sailing grad students and taking advantage of electronic means of consulting by visual images with onshore experts, etc).

Routing: CDEX, IOs

Background: There was difficulty in assigning biostratigraphers for IODP Expedition 333. None of the PMOs could send biostratigrapher nominees to CDEX, which then had to assign a shore-based biostratigrapher from IODP Expedition 322 to whom samples could be sent for analysis. This was new approach and the data became part of shipboard data. This biostratigrapher provided a preliminary assessment of Expedition 333 Site C0018 biostratigraphy during the expedition; however, those for Sites C0011 and C0012 were provided after the end of the expedition.

## **During Expedition**

### **Recommendation 332/333-04: Lab technician arrangement**

ORTF Exp.332/333 recommends considering a more flexible arrangement of lab technicians prior to the expedition start, according to staffing of onboard scientists and requests from Co-Chiefs and EPM.

Routing: CDEX

Background: The present arrangement of onboard technician on *Chikyu* is well established but not very flexible. For example, interpretation of X-CT images should be done by the scientists. On the other hand, the technicians could perform some of the routine sampling procedures. Furthermore, IT-related support is essential for onboard data processing. Therefore, a flexible and adequate assignment of lab technicians is important for the success of expeditions. According to requests from the Co-Chiefs and EPM, the arrangement of the onboard technicians should be changed adequately to obtain better scientific results.

## **Engineering**

### **Recommendation 332/333-05: Dynamic Positioning Methods and Transponders for *Chikyu* Scientific Drilling Operations (non-riser)**

ORTF Exp.332/333 recommends that CDEX and *Chikyu* personnel re-consider the option of establishing hydrophones and DP software on *Chikyu* to allow station keeping to be done with rapidly deployable, expendable seafloor beacons at sites not intended for riser operations.

Routing: CDEX

Background: The present method of carefully establishing multi-transponder arrays on the seafloor using expensive transponders that then must be recovered using

valuable *Chikyu* ship time is understood to be necessary and prudent for riser holes. However, for non-riser scientific drilling and coring operations in open holes the present method is overkill, expensive and excessively time consuming. The method for vessel positioning using expendable, less expensive seafloor beacons that can be free fall dropped from the ship is standard procedure onboard *JOIDES Resolution* and has a long-established record of success and time efficiency when conducting non-riser drilling operations. *Chikyu* could adapt to this method as an alternative when drilling at sites where the riser will not be deployed. Also, it is important to note that the requirements for dynamic positioning accuracy are less stringent for open hole drilling (compared with riser operations) where there are codified guidelines for acceptable vessel offset describing allowable upper and lower flex joint angles.

**Recommendation 332/333-06: Expand the Experience, Involvement and Authority of Core Techs on *Chikyu***

ORTF Exp.332/333 congratulates MQJ for adding full-time Core Techs to the drilling crew onboard *Chikyu*. This is a good first step; however, to maximize the benefit of the Core Techs requires that they be encouraged to grow in experience and authority with regards to drilling and coring operations for science. ORTF recommends that every effort be made to expand the Core Tech's role in every aspect of scientific drilling operations, including planning, plus hands-on experience with coring tools and drilling/coring operations. If feasible, it would be beneficial to arrange participation in *JOIDES Resolution* expeditions to learn from the drillers and Core Techs on the *JOIDES Resolution*.

**Routing: CDEX**

**Commentary:** This learning and growing process will provide the Core Techs with invaluable experience as well as lead to their becoming invaluable in helping to plan and execute future scientific drilling, coring and logging operations. This added expertise will better prepare them for dealing with the normal difficulties found in this type of deep sea operations, including such things as:

- Optimum bit selection for various scientific target lithologies.
- Definition of piston corer refusal depths and when to switch to alternate coring methods.
- When to plan holes as single bit attempts vs re-entry or multi-hole options.
- How to handle difficult core liner extractions on deck, and when core liner failures can be considered relatively normal vs abnormal.
- Understanding and communicating when poor core recovery is more likely to be caused by formation difficulties vs improperly functioning coring tools.
- Helping with general time estimating for coring operations in the planning stages.

There is really no substitute for hands-on, practical experience in these areas amongst experienced personnel onboard *Chikyu*.

**Recommendation 332/333-07: VIT Frame Alteration Back to Original Design**  
ORTF Exp.332/333 recommends that the Vibration-Isolated Television (VIT) frame be reconfigured back to original design with BUNGIE CORDS holding the inner up-down funnel to the outer frame.

Routing: CDEX

Commentary: This is an oilfield design predating ODP. It has proven successful in isolating the underwater TV camera and lights from damaging shocks while the frame is lowered down the outside of the drill string, as well as allowing the funnel-tube to bump its way over the hundreds of tool joints without hanging up. At present the steel cables that have been installed in place of the BUNGIE CORDS are causing unnecessary deployment and retrieval problems.

**Recommendation 332/333-08: Cementing operation**

ORTF Exp.332/333 recommends CDEX review previous cementing operations to identify any areas requiring improvement and explore new solutions, including alternate vendors for cementing services.

Routing: CDEX

Background: There has been a history of cementing problems during cementing and hole completion operations ever since the beginning of NanTroSEIZE. However, CDEX has to make a better effort to address these issues. Especially, cement mud contamination prevent system (Dart Deployment System) has been failing by some service provider. CDEX has been discussing the issues with the service provider, but has not reach the conclusion/found the causes and solutions.