IODP Operations Review Task Force Meeting

Expedition 310
Tahiti Sea Level

August 2nd- 3rd, 2006
Washington, D.C.

EXPEDITION 310 OPERATIONS REVIEW TASK FORCE PARTICIPANTS

Expedition 310 Task Force Members

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MEETING FORMAT

The IODP-MI Operations Review Task Force met on August 2nd-3rd at the IODP Management International office in Washington, D.C. to review the operational aspects of IODP Expedition 310 (Tahiti Sea Level). The review concentrated on "lessons learned" from the expedition with an emphasis on "what should be done differently in the future." The committee review was based upon confidential reports submitted by the ECORD Science Operator (ESO) and the Expedition 310 co-chief scientists.

The meeting began with oral presentations by Gilbert Camoin and Dave McInroy summarizing the co-chief scientist and ESO reports, respectively. Following these oral presentations, the Review Task Force identified specific pre-expedition, expedition, and post-expedition topics for discussion. The Review Task Force spent the remainder of the first day of the meeting discussing the issues and developing specific recommendations for ESO. On the second day of the meeting, the committee reviewed the recommendations and came to a consensus on each one. These recommendations are presented in this report.

EXPEDITION 310 SUMMARY

Expedition 310: Offshore Portion, October 6th – November 15th, 2005
Expedition 310: Onshore Science Party, Bremen, February 13th – March 4, 2006
Co-Chief Scientists: Gilbert Camoin, Yasufumi Iryu
Staff Scientist: Dave McInroy
ESO Operations Superintendent: Alister Skinner

IODP Expedition 310 was the first part of a multi-disciplinary program designed to delineate the history of sea-level and sea-surface temperature (SST) variation associated with the last deglaciation (20–10 ka BP) in the South Pacific. The primary scientific objectives were to establish the timing and course of the last deglacial sea-level rise, to define SST and SSS variations, and to analyze the impact of sea-level and environmental changes on reef development during the last deglaciation. An additional objective concerned the microbial populations and related processes and products on the Tahiti reef slopes in order to clarify the nature and the origin of fossil microbial features identified in previous Tahiti drill cores.

632 m of cores were recovered from 37 holes across 22 sites, with a conventionally-calculated recovery of 57.47% (70% for the last ten sites when the steel split-liner technique was used). Ultra-high-resolution geophysical downhole logging data have demonstrated that the average mesoscale porosity was about 30-35%, meaning that most, sometimes all, of the coreable material was recovered during the Expedition. The recovery of the postglacial reef sequence along three drilled transects, from 40 to 121 m below current sea level, included abundant high-quality coral samples and annually banded massive coral colonies suitable for paleoclimate studies.

A suite of downhole geophysical methods was chosen to obtain high-resolution images of the borehole wall, to characterize the fluid nature in the borehole, to measure borehole size, and to measure or derive petrophysical or geochemical properties of the formation,

such as porosity, electrical resistivity, acoustic velocities, and natural gamma radioactivity. Nearly complete downhole coverage of the last deglacial reef sequence and partial coverage of the underlying Pleistocene sequence have been obtained in 10 boreholes.

See http://www.ecord.org/exp/tahiti/310PR for more details regarding the background and objectives, the preliminary scientific results, and conclusions of Expedition 310.

RECOMMENDATIONS OF THE EXPEDITION 310 REVIEW TASK FORCE

Overall, the Expedition 310 Operations Review Task Force found that the Tahiti Sea Level expedition was an unqualified success. This success resulted from a combination of factors including, "Lessons Learned" from the ACEX expedition, experience gained by ESO working in the "IODP" environment, close collaboration between the co-chief scientists and operators, and a willingness and flexibility shown by all parties to work through issues as they arose at sea and onshore. All parties involved in this operation are to be congratulated on a very successful drilling and sampling venture, which the Task Force believes will produce a wealth of scientific knowledge for years to come.

The Review Task Force identified several areas of improvement for future MSP operations including:

- Pre-expedition planning
  - Staffing
  - Scientist training
  - Site surveys
- MSP Laboratory issues
  - Containerized space
  - Noise abatement
  - Microbiology methods/sampling
  - Frozen sample transport
  - Interstitial water storage protocols
- Coring issues
  - Core diameter
  - Core liners
- Onshore portion of expedition
  - Science party objectives
  - Scientist education
  - Core processing/sampling options
- Education and outreach
  - Media interaction.

Many of the issues discussed during this review are interrelated and, in some sense, the above divisions are artificial. However, they help in categorizing the issues and determining key problems to solve before the start of the next phase of IODP operations, in which three platforms may be operating simultaneously.

While the primary focus of this review was on ESO operations during Expedition 310, many recommendations in this report are equally valuable for other IODP operators, IODP management, and to the Science Advisory Structure. As such, some recommendations are also directed to these entities.

Pre-expedition Planning

Staffing and scheduling uncertainties

In general, pre-expedition planning went quite smoothly, despite several delays in the platform contracting procedure. Some staffing problems arose when the expedition was postponed from the July-August (2005) time frame to the October-November period. Two Science Party members had to be replaced because they had prior commitments for the new operation dates. Staffing has been a difficult issue with respect to MSP operations because of the inherent uncertainties associated with platform contracting and the need to schedule a different platform for each MSP operation; scientists must remain very flexible with respect to sailing dates. This need for flexibility is a new and difficult issue for many scientists used to more defined ODP/DSDP operations. The Task Force discussed this staffing issue in some detail, especially the need to make the community more aware that the DSDP/ODP staffing model will not work in with MSP operations (and, most likely, neither with riser drilling operations). In addition, the Task Force felt that the IODP staffing bodies need to be more proactive in generating a larger pool of qualified scientists for these operations and discussed several methods to increase the staffing pool.

> **Recommendation 310-01:** The Expedition 310 Review Task Force recommends that IODP management, the Implementing Organizations, and the Program Member Offices develop a staffing procedure that insures a sufficient qualified pool of scientists to accommodate changes inherent in the scheduling of MSP operations. This staffing contingency should include (1) education of the scientific community regarding the inherent uncertainties in MSP contracting and scheduling and (2) efforts toward recruiting graduate students and others outside the normal applicant pool (e.g., new members of the community).

Scientist training

The Task Force discussed the offshore and onshore science activities and responsibilities of Expedition 310 scientists, in particular the expectations of the scientists with respect to their particular job requirements. While the Task Force found that the ESO had, in general, done a good job with preparing Expedition 310 scientists for the type of activities that were expected of them, there was an overall feeling that IODP (both

management and the IOs) should take better advantage of the Internet to train scientists for all types of IODP expeditions. In particular, web-based tutorials could be developed describing offshore and onshore work environments and expectations. These tutorials could also provide detailed descriptions of such things as laboratory equipment and methodology, how to access data, how to use particular data types (e.g., logging data), how to access library/research information, etc.

> **Recommendation 310-02:** The Expedition 310 Review Task Force recommends that IODP-MI work with Implementing Organizations to develop web-based tutorials describing offshore and onshore work environments and expectations including job requirements, laboratory operations/methods, and data handling procedures.

Site surveys

A total of 120 seismic lines collected in the three drilling transect zones. On several lines, the hard bottom over most of the outer shelf inhibited sub-bottom penetration rendering problematic the interpretation of the recorded data (although some internal structure is revealed).

The digital swath bathymetry data provided initially by the IRD-Nouméa (and supplied with a grid spacing of 25 m) was also insufficient to locate drill sites accurately at the required depth (for science) and at a suitable slope angle (for operational safety). There were two separate instances of the DART unexpectedly landing on the seabed during taut-wire depth surveying, which resulted in the loss of the stinger. Co-chief Camoin took steps to obtain the raw bathymetric data files from the engineer who processed the original grids in New Caledonia. These files were downloaded from a remote ftp site and re-gridded to 5 m and 3 m by the Staff Scientists. The new grids provided a much better basis for locating drill sites, as previously unresolved reef pinnacles could now be located.

However, even with this additional refinement, the topography still did not agree with existing maps at many sites, especially on the shelf edge. Various surveys with the ship, taut wire, and lead line just served to confirm this discrepancy as well as to damage the taut wire system. Ultimately, a high-resolution shallow-water echosounder was located onshore and purchased by the operations superintendent for the project. After some trials to obtain the best settings, this echosounder (deployed through the moonpool) allowed suitable drilling sites to be located.

The above information illustrates the difficulty of imaging drilling targets in reef environments and the need for a good site investigation with accurate and detailed site survey bathymetry data and their related processing prior to coring. The Tahiti operation has been a valuable "lesson learned" operation for ESO with respect to implementing future coral reef operations and gathering the required site-specific survey data sets.

In sum, the Expedition 310 Review Task Force recognizes that accurate and detailed high-resolution swath bathymetry data (gridded to 3-5 m, and perhaps using backscatter imagery) are essential for drilling of coral reefs, and that other data (other than high-resolution seismic data) may be of little value. It is important that IODP consider these observations during the proposal review, nurturing, and ranking process. Therefore, the Task Force recommends that the IODP Site Survey Panel consider the availability of detailed high-resolution swath bathymetry data sets when classifying site survey data completeness for future reef drilling proposals.

> **Recommendation 310-03:** The Expedition 310 Review Task Force recommends that the Site Survey Panel consider the availability of properly gridded high-resolution swath bathymetry data when classifying site survey completeness for operations involving reef drilling.

MSP Laboratories/Offshore Core Processing:

As with Expedition 302 (ACEX) expedition, only limited scientific observations, analyses, and measurements were conducted at sea, including the basic visual description of all cores and core-catchers, petrophysical (i.e., Multi-Sensor Core Logger) measurements, pore-water sampling, and microbial measurements/sampling. These scientific activities were distributed among the containerized laboratories that ESO had installed on the DP *Hunter*. The Review Task Force discussed several issues related to the MSP laboratory operations and core processing/sample analyses.

Containerized space

The Task Force learned that the working conditions for core description were far from ideal. The ambitious scientific party attempted a far more intensive core description effort than was anticipated during the pre-cruise planning. As a result, there wasn't any containerized space allocated (or available) for core description during the expedition and the scientists had to work outside in a makeshift laboratory in the heat and rain (despite ESO efforts to rig up a temporary shelter with tarps). In addition, there was insufficient light for core description and the noise in this outside environment hampered normal conversation. The Task Force discussed this situation in particular and that of "containerized" laboratories in general.

The Task Force members concluded that this core description scenario was a "lesson learned" situation in that the IO needs to plan for "maximum human involvement." In other words, given the time and opportunity, scientists will attempt to expand upon the minimum required work while in a dedicated offshore environment.

The Task Force did not make a specific recommendation with respect to allocation of containerized space. Clearly, the number and disciplinary allocation of containers will be dependent on the platform and funding. The Task Force recognizes and applauds ESO's efforts toward continuing with improvements of this containerized approach and that a

major “lesson learned” from Expedition 310 has been to plan for “maximum human involvement”.

Noise abatement

A side-effect of the use of an outdoor area for core description was the noise associated with drilling operations and other ship functions. As discussed above, much of this problem can be solved by insuring that core description areas are properly housed in containers. In addition to this noise issue related to the core description during Expedition 310, the Task Force discussed laboratory noise conditions in general and possible abatement methods. The Task Force realized that each MSP operation will have unique issues to solve with respect to noise abatement and thus any solution will have to involve a discussion of science needs, platform space, laboratory size and characteristics, etc. The operator should have this discussion as an agenda item during each pre-cruise meeting to ensure that co-chiefs are aware that noise can be a big issue during MSP operations and then implement appropriate remediation to fit the safety and science concerns specific to each MSP expedition.

> **Recommendation 310-04:** The Expedition 310 Review Task Force recommends that Implementing Organizations discuss laboratory noise considerations with co-chief scientists at pre-cruise meetings and implement appropriate remediation (e.g., two-way headsets, noise-canceling headsets, etc) to minimize noise and maximize communication in the laboratory environment.

Microbiology measurements

During Expedition 310 microbiological studies were conducted for the first time on reefal sediments recovered as part of drilling operations in South Pacific tropical waters The microbiological work conducted on Expedition 310 appears most promising. Although the microbiologists on Expedition 310 had previous experience in carrying out geomicrobiology research in field campaigns, they faced many new problems onboard the *DP Hunter* (e.g., the vibration of the ship’s engines made it difficult to obtain sharp microscopic photographs with the 100X objective). Furthermore, the microbiology container was not a “clean lab” and the temperatures inside the container were usually too high as the small mobile air conditioner did not work during part of the expedition. Some microbiological measurements could not be done well and were not reproducible because it was too hot in the container.

The co-chief scientist report contains many suggestions regarding basic equipment and setup for microbiological analyses on MSP platforms (e.g., glassware, autoclave, stirrers, pH meter, water purification, “clean” and “dirty” working places, etc). These particular needs, however, speak to a greater issue for IODP, that of fully understanding how IODP should interact with the microbiology community. Even with an “ IODP minimum measurements” document now in hand, there is still a lack of specificity with respect to the types of microbiological samples and data that need to be collected on IODP platforms and the methodology needed to collect those samples. The Task Force believes these issues need resolution in order for IODP to interact effectively with the microbiology community.

Recommendation 310-05: The Expedition 310 Review Task Force recommends that IODP-MI request the Scientific Technology Panel (STP) and the participants in the upcoming Microbiology Workshop to provide more specificity regarding the types of microbiological samples and data to be collected on IODP platforms and the methodology employed to collect the samples and data.

Interstitial water sample contamination

During Expedition 310, ESO followed standard ODP/DSDP protocols involving the use of sealed glass vials for storage of splits of interstitial water samples. Unfortunately, this methodology resulted in serious B and Si contamination in sample splits utilized for some of the post-expedition IW analyses to be conducted by Expedition 310 geochemists. The Task Force discussed the issue and thought that the best path forward to avoid future contamination issues would be to have the Scientific Technology Panel review current IW sample storage protocols on all IODP platforms and recommend changes as appropriate.

Recommendation 310-06: The Expedition 310 Review Task Force recommends that IODP-MI request STP to address protocols/procedure for IW splits to ensure proper archiving techniques are employed on all IODP platforms.

Frozen sample transport

The Review Task Force was informed that frozen microbiology samples thawed somewhere during transit from Los Angeles and their final destination in Europe. As a result, certain DNA analyses could not be conducted on these samples. Transporting frozen samples is always fraught with difficulty and must be well coordinated. Sample shipments can be delayed for a number of reasons (e.g. customs issues) and, in the end, the samples may arrive at the host institution when there is no one available to accept the shipment.

MSP operations differ from those of the JOIDES *Resolution* and *Chikyu* in that the MSP operator must remove the samples from the platform following each expedition, even if the port is not ideal or conducive for shipping frozen samples. The Task Force discussed possible solutions for this problem, including using personal custodians for sample shipments or using one of the other IODP platforms to store samples until they can be safely transported. In the end, the Task Force thought that the ESO should examine their frozen sample shipment procedures and work with the other IOs to develop new primary and backup frozen shipment protocols for IODP platforms.

Recommendation 310-07: The Expedition 310 Review Task Force recommends that the IOs review protocols/procedures for shipment of frozen microbiological samples following an expedition. Potential procedures could include the use of "personal custodians" and/or the use of IODP platforms for temporary storage.

Internet capabilities

The Offshore participants of Expedition 310 did not have Internet access (i.e., web-based access), although they were able to send and receive email on a daily basis. The Task Force discussed the issues surrounding Internet access. Shipboard scientists not only wish to use the Internet for email access but also for routine expedition-related scientific research (e.g. library/reference access) and non-expedition related communications and research (e.g., submitting on-line abstracts, addressing university issues, etc).

The Review Task Force recognized not only the high expectations of the scientific community for full-time internet access in this day and age, but also the issues associated with providing this capability on a full-time basis, especially for MSP operations. The overwhelming view by Task Force members was that Internet capability on MSP (and other IODP) platforms should accommodate the "science" needs for the expedition. These "science needs" should be determined well in advance of the expedition by the operator and co-chiefs.

> **Recommendation 310-08:** The Expedition 310 Review Task Force recommends that ESO work with future MSP co-chiefs to determine the level of Internet access required for the science needs of the expedition.

Coring Issues

Coring diameters

ESO informed the Task Force that core size/diameter is an important issue when tendering for an MSP operation. In addition to scientific issues associated with the diameter of the core there are important logistical and budgetary ramifications for coring, logging, core processing, core transport and ultimately, core archival. The Task Force believed that it is important to examine each of these areas in more detail so that a reliable cost/benefit analyses can be made if a tendering decision requires a decision on core diameter outside the IODP norm.

> **Recommendation 310-09:** The Expedition 310 Review Task Force recommends the IODP-MI work with the Science Advisory Structure (particularly STP and EDP), the IOs, and the associated IODP core repositories to develop a report detailing the drilling/coring, core processing, and core archival issues and ramifications associated with core diameters significantly outside the IODP norm.

Core liners

The Task Force learned that Expedition 310 core was initially collected in an industry-standard HQ3 PVC liner tube, which served as the triple tube of the HQ3 system. However, due to the nature of the coral formation, this plastic liner kept being crushed or torn and also contributed to early bit blocking. After discussion with the scientists the traditional stainless steel or chromed steel split liner insert was used as a trial and

thereafter was continued for the rest of the project with demonstrable improvements in core recovery, core quality and rates of penetration.

The Task Force did not have a specific recommendation with respect to core liner options on future MSP expeditions. This is primarily a "lesson learned" for future coral/reef drilling operations (e.g., Great Barrier Reef). The Task Force, however, applauded the interaction between the operator and scientific staff in working together toward a solution to this problem.

Onshore MSP Operations

The onshore portion of Expedition 310 was held at the Bremen Core Repository. The Review Task Force discussed numerous areas of the operation, including core analyses, sampling, and scientist expectations during this portion of the expeditions. Overall, the Task Force was impressed with the "lesson learned" from the previous onshore work (Expedition 302), which resulted in the Expedition 310 Onshore operation ending up as a great success. However, the Task Force did have several recommendations to make, one general in nature, the other two more specific.

Nature of onshore science party

Much of the confusion and expectations by the science community about the onshore portion of the MSP expedition relate to the fact that it is still a relatively new aspect of IODP operations. This portion of the expedition is meant to simulate the offshore environment where the science party works as a team to process the cores, collect data and work to develop a first-order science interpretation of the results. The *esprit de corps* developed by working on a specific problem in a "closed" environment is invaluable toward producing a high-quality science product. Educating the community to understand this goal of the onshore portion of MSP operations (and the fact it is not merely a "sampling party") is paramount to its the success.

> **Recommendation 310-10:** The Expedition 310 Review Task Force recommends that IODP-MI work with the ESO, the Program Member Offices, and the Science Advisory Structure to develop specific educational efforts to raise the awareness of the community as to the objectives and importance of the onshore portion of MSP expeditions.

Onshore science party expectations

The Task Force discussed that fact that some scientists still are confused about what their specific duties and responsibilities will be during the onshore portion of an MSP expedition. Over time, this confusion will wane as more and more scientists participate in these MSP expeditions. In addition, ESO has developed written documentation that describes these duties and responsibilities. However, in the near term, the Task Force thought it would be very beneficial to develop a pool of previous participants from past MSP expeditions who would be willing to answer questions from prospective MSP scientists.

Recommendation 310-11: The Expedition 310 Review Task Force recommends that IODP-MI and ESO engage previous participants in MSP onshore science parties and make use of the web to answer commonly-asked questions from community scientists about objectives and working conditions of the onshore portion of the MSP expedition.

Sampling techniques

The Task Force discussed the sampling process for the Expedition 310 cores (and all onshore MSP expedition, in general). Unlike *JOIDES Resolution* expeditions, where the science party can view all the cores before sampling on shore at a later date, the MSP onshore operations have generally consisted of opening, describing and sampling each core before moving on to the next core. This type of operation does not allow scientists to view the entire sampled sequence before determining the best sampling strategy (and thus minimizing sampling needs). While some lithologic information can be determined from examining core logs and downhole logs, it is often necessary to view the all the cores (or at least certain subsets) before developing an effective sampling strategy. The Review Task Force thought that ESO should examine a number of different core processing and sampling scenarios to understand more fully the space, time, and other logistical ramifications that such changes might make to the onshore portion of the MSP expedition (should they be implemented). ESO might wish to utilize the Annual Curatorial Meeting to discuss processing scenarios with all IODP curators.

Recommendation 310-12: The Expedition 310 Review Task Force recommends that ESO examine a variety of core processing and sampling scenarios to determine the most effective means to minimize over-sampling during the onshore portion of the MSP expedition. These scenarios should be discussed with co-chiefs during pre-cruise meetings to design the most effective science strategy within the logistical constraints of the operation.

Education and Outreach

Media and outreach activities

The Review Task Force heard about a variety of outreach activities (including press conferences and TV/Film operations) that were conducted for both the onshore and offshore portions of Expedition 310. Many interviews were given for newspapers, radio, and TV. This major media effort oftentimes resulted in critical areas of the repository being closed by TV crews for several hours. In addition, at times there were just too many demands on scientists' time. In future operations, media interaction needs to be more clearly defined (e.g., time slots, space allocation, responsibilities, etc) for both onshore and offshore operations.

Recommendation 310-13: The Expedition 310 Review Task Force recommends that the ESO and IODP-MI communication groups develop well-defined protocols and plans for media/scientist interaction to ensure that critical scientific operations are not hindered.

Recommendations for IODP-MI Operations Review Task Force:
At the end of the meeting, the Task Force members were asked for suggestions and/or recommendations to improve how IODP-MI conducts these operational reviews. The Task Force suggested two areas of improvement, including changes to the "Briefing Book", and SAS representation at the meeting.

1) Briefing book
The Task Force recommended that IODP-MI should provide a preamble to the Briefing Book that summarizes the main issues brought forth in the co-chief and operator reports in the context of relevant Task Force recommendations from previous expeditions.

2) SAS representation
The Task Force recommended that IODP-MI include appropriate members of SAS (e.g. STP chair) when issues in either the co-chief or operator report clearly require input from SAS or when potential recommendations might concern the SAS.

IODP-MI will implement these suggestions for the next Operations Review Task Force meeting.