NanTroSEIZE Project Scoping Group meeting
February 24-24, 2005
El Dorado Hotel, Sante Fe, NM

Attendees:

Project Scoping Core members

Janecek, Tom	IODP-MI
Kimura, Gaku	University of Tokyo
Kinoshita, Masataka	IFREE, JAMSTEC
Kuramoto, Shin'ichi	CDEX, JAMSTEC
Tobin, Harold	New Mexico Tech
Underwood, Mike	University of Missouri

Technical Implementation members

Klaus, Adam	TAMU, USIO
Masago, Hideki	CDEX, JAMSTEC
Yohroh, Tamio	CDEX, JAMSTEC

Science Advisory Structure liaisons

Becker, Keir	RSMAS, University of Miami

Guests

Nathan Bangs	University of Texas Institute for Geophysics
Achim J. Kopf	University of Bremen
Randy Normann	Sandia National Laboratory (Feb 25 only)

Location
Eldorado Hotel
309 West San Francisco Street
Santa Fe, New Mexico 87501

Tel: (505) 988 4455
Fax: (505) 995-4555
www.eldoradohotel.com

Date and Time

Thursday, February 24, 2005
08:30 -17:00

Friday, February 25, 2005
08:30 – 17:00

Continental breakfast will be provided at 8:00 am
Lunch: Adjourn to one of the local eateries

Meeting Room in Hotel: To Be Announced

Meeting Host
Harold Tobin
Earth and Environmental Science Department
New Mexico Tech
Socorro, NM 87801
Tel: (505) 835 5920 / Email: tobin@nmt.edu

Hotel Information
Eldorado Hotel :Address above

Rooms have been set-aside for the nights of Wednesday, February 22, Thursday 23, and Friday 24 at a special rate of $94 plus tax (currently 14.3125%).

To make a reservation (Important Deadline Information)

Please telephone the reservations department directly at 800-955-4455; by faxing your reservation request to 505-995-4544; or by accessing email reservations at rez@eldoradohotel.com ON OR BEFORE Monday, February 14, 2005. Mention the IODP Management International/NanTroSEIZE when reserving, and please provide your arrival/departure dates along with a credit card number to guarantee your reservation.

Airport Transportation

Albuquerque International Airport is situated less than an hour from Santa Fe. Shuttle Service is offered by several companies, ranging in price from $20-25 per person, one way.

Sandia Shuttle Express
1-888-775-5696 (toll free)
In Albuquerque (505) 242-0302

Santa Fe Shuttle
Telephone 1-888-833-2300 (toll free)
In Albuquerque (505) 243-2300

Agenda

1. **Review Action Items from October 2004 PSG meeting**
   A watchdog has been assigned to report the status of action items generated at the previous meeting and to bring closure to that item, if possible   If the item is to be covered in more detail later in the agenda only a short update is needed.
   a. PSG Mandate (Janecek)
   b. Contingency Planning for All Sites (Tobin)
   c. Define Critical Data Sets (Tobin and Kinoshita)
   d. Define Site Survey interpretation and review procedures (Kuramoto)
   e. Develop Data Requirements worksheets for each site (Tobin, Kinoshita, Kuramoto)
   f. Develop procedures for prioritizing sites into overall drilling plan (Tobin, Kinoshita)
   g. Designate scientists to work with eng. for geo-prediction for drilling (Tobin, Kinoshita, Kuramoto)
   h. Explore task force for IODP Observatory science (Janecek)
   i. PSG Task Forces (Tobin, Kinoshita)

2. **Updates from SAS/IOs/Proponents**
   The presenters in this section should provide brief (<10 min) updates on the items as they pertain to issues (if any) related to NanTroSEIZE drilling (e.g., operations, scheduling, drilling, ship status, etc).
   a. Operations and Program Plan Updates **(Janecek)**
   b. Proposal 603-C, 603-D Update **(Tobin and Kinoshita)**
   c. SAS Update **(Becker)**
   d. Chikyu Update **(Kuramoto)**
   e. JOIDES Resolution and SODV updates **(Klaus)**

3. **Mandate Approval (Janecek)**
   A draft mandate will be discussed, modified, and approved by PSG core members.

4. **Site-by-Site Scoping (Tobin, Kinoshita, Underwood)**
   Review each proposed site one by one, including revisions to planned penetration depth discussed at the last PSG. ***Pre-meeting preparations should include a prepared table that provides details of:***
   a. Depth of penetration
   b. Predicted geology, major targets
   c. Coring, downhole measurements plan
   d. Long-term observatory objectives as proposed
   e. Scientist prediction of possible challenges, hazards (e.g., hydrate, overpressure)

   The objective of this agenda item is to make sure that all PSG members (both engineering and science side) fully understand of what is proposed.

After this basic information is compiled, discussed and agreed upon, we can begin an *initial site scoping* including :

- Riser or riserless drilling requirements?
- How much casing is necessary?
- Special wellhead requirements for long-term?
- Other engineering considerations?

5. **Long-term monitoring planning (Kinoshita and Tobin)**
   a. Riser-less holes
   b. Riser wellhead holes
   c. Proposed task force on long-term monitoring development

   The major objective of this agenda item for the PSG to agree on a way forward and designate a subset of PSG members (and other experts) to more fully develop the long-term NantroSEIZE plans. Topics might include:

   - Who is responsible for which parts of observatories (IOs and scientists?)?
   - Are non-riser and riser hole observatories to be handled differently? How?
   - How can we coordinate and target engineering efforts?
   - Can we agree on task force members?
   - How to integrate this NanTroSEIZE observatory group into the IODP Observatory Task Force to be started by IODP-MI?

6. **3D Seismic and Other Site Survey Activities (Kuramoto, Kinoshita, Tobin)**
   The objective for this agenda item is to provide the PSG with an update on positive developments toward 3D seismic acquisition, and decide how to move forward on negotiating contract, and parameterize survey to preserve both science and engineering (hazard survey) goals of acquisition.
   a. 3D survey – parameters and coordinating negotiations (CDEX, IFREE, NSF/U.S. proponents)
   b. Other site surveys update
   c. Interaction with SSP/EPSP and site survey databank

7. **Sites and Order of Drilling Operations (ALL)**

The JOIDES Resolution will be off-contract in Jan 2006 and a new riserless vessel will most likely not be on-line until mid FY07 at the earliest. Thus it appears that the first ship to the NanTroSEIZE area will be *Chikyu*. The goal here is to decide the operational order for drilling operations and what might be potential scheduling scenarios.

8. **Other Items**
9. **Review Action Items**
10. **Adjourn**

Report of the NanTroSEIZE PSG

Sante Fe, New Mexico February 24-25, 2005

Attendees:

Project Scoping Core members

Janecek, Tom	IODP-MI
Kimura, Gaku	University of Tokyo
Kinoshita, Masataka	IFREE, JAMSTEC
Kuramoto, Shin'ichi	CDEX, JAMSTEC
Tobin, Harold	New Mexico Tech
Underwood, Mike	University of Missouri

Technical Implementation members

Klaus, Adam	TAMU, USIO
Masago, Hideki	CDEX, JAMSTEC
Yohroh, Tamio	CDEX, JAMSTEC

Science Advisory Structure liaisons

Becker, Keir	RSMAS, University of Miami

Guests

Bangs, Nathan	University of Texas Institute for Geophysics
Kopf, Achim	University of Bremen
Normann, Randy	Sandia National Laboratory (Feb 25 only)

Dates and Times
February 24, 2005 8:30 –17:30
February 25, 2005 8:30 –15:30

Place:
Eldorado Hotel, Sante Fe, New Mexico, USA

Original Agenda

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    e. JOIDES Resolution and SODV updates **(Klaus)**

3. **Mandate Approval (Janecek)**

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5. **Long-term monitoring planning (Kinoshita and Tobin)**
    a. Riser-less holes
    b. Riser wellhead holes
    c. Proposed task force on long-term monitoring development

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    a. 3D survey – parameters and coordinating negotiations (CDEX, IFREE, NSF/U.S. proponents)
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    c. Interaction with SSP/EPSP and site survey databank

7. **Sites and Order of Drilling Operations (ALL)**

8. **Other Items**
9. **Review Action Items**
10. **Adjourn**

Meeting Report

1. **Review Action Items from October 2004 PSG meeting**

   Most of the discussion regarding these action items was incorporated into specific agenda items for this (February meeting) and thus were discussed during that portion of the meeting. A few additional notes are presented below

   a. PSG Mandate

      Most of this discussion was deferred to Agenda Item 3 (below). The chair, however, explained that he would also like the group to consider the wording for a "generic" PSG mandate and one that was more specific to NanTroSEIZE.

   b. Contingency Planning for All Sites

      See Agenda Items 5 and 6 below

   c. Define Critical Data Sets
      - See Agenda Items 5 and 6 below
   d. Define Site Survey interpretation and review procedures
      - See …..
   e. Develop Data Requirements worksheets for each site
      - See agenda Item 9 below
   f. Develop procedures for prioritizing sites into overall drilling plan
      - See Agenda Items 5 and 6 below
   g. Designate scientists to work with eng. for geo-prediction for drilling
      - Tobin noted that has initiated discussion with a group consisting of Harold Tobin, Peter Flemings, Demian Safer, and Nakamura to provide more scientific input to CDEX well engineers
   h. Explore task force for IODP Observatory science
      - Janecek noted that IODP-MI is planning on developing a IODP-wide observatory task force in FY06 for the management of boreoles. The Task Force would have mandates related to engineering, data management, and international coordination of borehole usage.
      - The Task Force might start up a smaller effort dealing with either NantroSEIZE or Monterey Bay issues and then use the protocols and procedures developed for these particular programs to scale up to overarching issue.
      - Also see Agenda item 7 below
   i. PSG Task Forces
      - The PSG discussed several areas that would benefit from sub-groups or Task Forces reporting to the PSG including
        1. Pore-pressure prediction
        2. Seismic data analysis and interpretation
        3. Manageing borehole science
      - See also Agenda Item 7 below

2. **Updates from SAS/IOs/Proponents**
   PSG members provided updates to the group.
   a. **Operations and Program Plan Updates (Appendix A: slides 21-25)**
      Janecek outlined the normal plan for program development and the specific plan for FY07.

   b. **Proposal 603-C, 603-D Update (Appendix B)**
      Harold Tobin and Mike Underwood updated the PSG with the status of the NanTroSEIZE CDP proposals.

- 603-C Deep plate boundary site. Single deep hole. Back from external SSEP review. Proponents response letter submitted. SSEPS forwarded to SPC for March SPC ranking meeting meeting, EPSP review coming up
- 603-D Non-riser site observatories; SSEPs sent back to proponents for revision to obtain more specific information about what should get done and prioritize.. Not previewed yet by EPSP
- 603A- Residing at OPCOM. EPSP previewed
- 603B- Residing at OPCOM. EPSP previewed, request for shallow seismics and amplitude maps, seeps, hydrate issues, velocity data

Discussion ensued on issues surrounding site survey status and EPSP reviews and two action Items:

Action Item 0502-1: Chair to discuss with EPSP how and when each site should be reviewed by EPSP.

Action Item 0502-2: Chair to Contact Site Survey Data bank to determine status of proposals with respect to Site Survey data

   c. **SAS Update**
      Keir Becker updated the PSG on changes to the SAS. Of particular interest to the PSG is the formation for the Engineering Development Panel (formerly TAP) and the change of SCIMP to the Scientific Technology Panel.

      The panel was informed about the Industry Workshop led by Manik Talwani, which has the goal of engaging industry at the management level to investigate potential opportunities for IODP/industry interaction.

   d. **Chikyu Update (NanTroPSG2_App_C)**
      Shin'ichi Kuramoto updated the PSG about the status of Chikyu operations, including information about the sea trials (2 to date), duration of shakedown cruise, and expected delivery dates to international operations (late FY07).

The PSG expressed concerns about JAMSTEC doing "IODP" science during the shakedown and asked about locations of shakedown cruises (Kumano Basin?). The PSG encouraged CDEX to consider utilizing scientists from the international community during these operations.

e. JOIDES Resolution and SODV updates (NanTroPSG2_App_D)

Adam Klaus updated the PSG about the status of the current non-riser schedule, including issues surrounding clearances (Monterey and Gulf of Mexico) staffing (balancing between members),and the progress towards procuring the Phase 2 non-riser vessel.

3. Mandate Approval (NanTroPSG_App_A [slides 11-19] and Appendix NanTroPSG2_App_E)

Janecek distributed a draft of the mandate for NanTroSEIZE PSG and asked for input from PSG members by the end of the meeting. The PSG agreed that the group is probably better termed a "Project Management Group" and suggested the name be changed. The Chair indicated he would consider this request.

Appendix E contains some suggested revisions to the Mandate. Additional modifications/mandates suggested by the PSG members include (1) providing advice on staffing and (2) linkages to funding agencies, proponents and other programs.

Appendix E also contains a NanTroSEIZE specific mandate for use in presentations or other outreach activities.

Action Item 0502-3: The Chair will incorporate all the input and finalize the generic and NanTroSEIZE specific mandates.

4. 3D Seismic and Other Site Survey Activities

a. 3-D Survey (Appendices NanTroPSG2_App_F and G)

Harold Tobin briefly discussed the overall international efforts toward 3-D site-survey preparations (CDEX, IFREE, NSF) and then Tomio Yohroh went into more specific details about the survey history, objectives schedule, location, and acquisition and processing parameters

Several issues arose that will require early PSG input, including:

(1) determining what are the highest scientific needs [i.e, earliest priorities; Splay faults, Decollement],
(2) how to optimize availability of pre and post STM data for drill site refinement and shallow hazard assessment by EPSP,
(3) the need to obtain contracting guidance from companies or individuals that have conducted industry 3-D surveys,

(4) how will US (NSF) funds be intergrated into the survey,
(5) who will coordinate the survey [CDEX?],
(6) the need for gravity and magnetic data?

Action Item 0502-4: Tamio Yohroh, Nathan Bangs, Shin'ichi Kuramoto, and Harold Tobin to discuss details regarding coordination of 3-D Survey and report back to PSG

Action Item 0502-5: T. Janecek to inquire at Industry Workshop about industry representatives who could provide advice with contract 3-D Survey negotiations.

b. Other site surveys update (NanTroPSG2_App_H)

Achim Kopf described the **M**eBo drilling & **I**n situ-measurements in the **N**ankai **T**rough accretionary prism (MINT) cruise scheduled for April 2006 with the R/V Sonne which will involve drilling (with a PROD-type drill), gravity coring, and deployment of CPTs, heat flow probes, and CAT meters, and pore-pressure instruments (SAPPIs). Kopf requested input from the PSG on a number of issues including the staffing, conflicts with other operations (i.e., surveys, other desirable data sets, use of Kochi core repository.

5. Site-by-Site Scoping

This section is a compilation of discussion from the both the first and second day of the meeting. In particular, a discussion of hazards, challenges, and coring requirements from the second day is integrated into this site-by-site scoping summary.

Harold Tobin first presented a summary table **(NanTroPSG2_App_I)** for each site that provides details of parameters such as total depth, predicted geology, coring requirements, downhole measurements, hazards, etc. This table is a work-in-progress that will be refined into a package, along with such things as seismic lines, prioritized objectives, etc., for the IOs to use as a planning tool.

The individual sites were then discussed by PSG.

Reference Sites – (NanTroPSG2_App_J)

Mike Underwood presented details of the proposed operations at the Reference Sites including:

NT01-01 (Basement High)
NT01-02 (Basement Plain)

NT01-06 (Shikoku Basin)
NT01-03 (Prism Toe)
NT01-04 (Trench)
NT01-05 (Trench)

Specific discussion comments/issues :

- There was general agreement that NT01-01 is the best spot for deepening basement and a target depth of 100-200 m is ideal. This site is the least likely to have sand and casing may not be required to reach Total Depth. Site 1173 could be used as an operational model. The site does not need to be cased for future re-entry.

- There was a consensus among PSG members that Lower Shikoku Basin facies in NT01-02 is not well defined and NT01-06 provides a better alternative. The disadvantage of this alternative sites is that it is farther from NT01-01 for linked hydrogeology experiments

- NT01-04 is a channel levee complex and thus is not a prime target. NT01-05 provides a better alternate for monitoring strain transients. While deep penetration is ideal, good results could be obtained with penetration to only 500-600 mbsf.

- There are some major unresolved issues regarding seismic interpretations for NT01-03, For example, it is unclear where to place the decollement. In addition, the basement is deep ((>2300m) and thus may become a lower priority to that of reaching the frontal thrust at ~500-600 mbsf. Sand could be present.

Splay Faults: (NanTroPSG2_App_K)
Masa Kinoshita presented the initial proposed operational details for the 603B Splay Fault sites including

NT02-01- Shallow branch of Splay Fault
NT02-02 – Intersection of Splay Fault at 2000 mbsf
NT02-03 – MegaSplay at 3000 mbsf
NT02-04 – Kumano basic uplift history

Specific discussion comments/issues:

- The primary objective at NT02-01 is to sample and instrument the Splay Fault; deeper penetration and pairing with other sites are lower priorities. NT02-01 is a high priority site in which 3D Seismic data would be extremely useful in determining the final site location.

- NT02-02 is poorly imaged and the proposed location of fault is based on geometric arguments rather than seismic character. 3D seismic acquisition is required before drilling. In addition, NT02-02 is a structurally complex site which could be difficult to drill in riserless mode. This is not a site for early operations and should await acquisition and interpretation of 3D seismics before determining if it should be drilled.

- NT02-03 is also poorly imaged and needs 3D seismic acquisition before proceeding. NT02-02 and NT02-03 could possibly be merged into one site.

- The lower section of NT02-04 is of lower priority as it would be sampled by NT03-01 (riser) site and thus NT02-04 could be drilled to only 1300 mbsf. Operations at this site would utilize LWD to 1300 mbsf and then emplace a P-CORK.

- Detailed seismic stratigraphic analysis throughout the Kumano Basin is essential before drilling commences

Deep Riser Site (NanTroPSG2_App_L)
Harold Tobin presented the proposed operational details for the deep riser site NT03-01.

Specific comments:

- This is a multi-stage drilling operation with a pilot hole that will be cored/logged to 1000 m, with further deepening to ~5800-6000 mbsf and then finally initiating a sidetrack hole above the Mega Splay.

- New seismic velocity model data brings the expected Total Depth to ~5600 mbsf. Basement penetration is expected to be on the order of 200 m.

- The prioritization of information obtained from this hole is as follows:

    - The core/logs (geologic information),
    - Seismicity and active source seismic data recorded on a borehole array
    - Pore pressure, strain/tilt information
    - long-term fluid chemistry
    - EM-conductivity.

6. Sites and Order of Drilling Operations (NanTroPSG2_App_M)

The PSG began to address the order of operations after it analyzed the specific site-by-site operations. A series of overarching principles were discussed to help guide the discussion:

- Start with easier things, work up to bigger challenges
- Build time into schedule between operation stages to use data to adjust next stages
- Try simple observatories first and then work up to complex installations. Test technologies in simple versions
- Build in flexibility. Assume boreholes can be used for many years but instruments will fail and instruments will need to be extracted.
- Identify critical decisions that will affect later operations (casing, well-head, cemented instruments). Plan these carefully

Based upon these guidelines, a series of "Stages" were discussed. No attempt was made to determine the operational time necessary to complete a "Stage", which could range from less than one "standard" two-month expedition to multiple expeditions.

Stage 1: Drill and Core in riserless mode

- NT01-01 to TD, drill and core, LWD
- NT01-02 to TD, drill and core, LWD
- NT01-03 to 1400 m
- NT03-01 upper 1000 m
- NT02-04 (1300 version) core, LWD emplace P-CORK

No other CORKing in any hole, Case only as necessary for non-riser drilling

Stage 2: More riserless drilling, Some CORK-style installations

- NT2-01A/B, drill core, log Hole A; case, install pore pressure and seismometer in Hole A; Drill and wireline packer test in Hole B
- NT2-02, drill, core, log, no observatory
- NT2-03, drill, log, core, upper ~1000 (preparatory for riser work)
- NT1-01, NT1-02 return for observatory installations

Stage 3: Riser Site to 3000 mbsf

- NT2-03, deepen to 3150 m TD, combination of coring/LWD, install casing
- Install simple retrievable observatory

Stage 4: Riser Site to 6000 mbsf

- NT03-01, Deepen to TD with LWD, casing
- Sidetrack to take continuous cores across faults
- Install removable "simple" observatory

THEN: Wait for a significant period to record borehole data, then complete layout of final instrument configuration for two deep observatories

Stage 5; Install Full Deep Monitoring System

NT2-03 and NT3-01, Deploy final monitoring systems in boreholes.

Comments/discussion on proposed stages

- Prioritization is key. It is essential to know what is to be accomplished at each stage so the future steps can be planned and executed.
- Need to think beyond concept of "standard" two-month expeditions for planning purposes.
- Will need to have operational and science reviews after each stage (and at least operational reviews after each expedition within each stage).
- Need to evaluate initial data from observatories and then refine objectives based on early monitoring. Thus it is important to have some component of observatory operations in the early stages.
- 603D proposal – determine early whether working properly, adjust/replace as required. This concept needs to be built into proposal.
- Need to develop long-term funding strategy for observatory science

Action Item 05-02-6: PSG needs to develop standard presentation format of Site Scoping information that includes prioritized coring/logging/monitoring operations, seismic line (with interpretations), prioritized site science objectives.

7. Long-term monitoring planning and infrastructure for Borehole Observatories (NantroPSG2_App_N; NantroPSG2_App_O)

Masa Kinoshita and Harold Tobin informed the PSG of progress towards organizing a focused meeting bringing together interested persons with specific expertise in the relevant observatory components. Tobin indicated that he would approach USSSP for funding and potentially coordinate the meeting with SAFOD. Tobin and Kinoshita presented a preliminary list of names for workshop attendees (NantroPSG2_App_O) and asked the PSG members to contribute additional names (especially from Europe, ICDP, and SAFOD).

A discussion ensued on the responsibility of the IOs and proponents with respect to funding various parts of the observatory systems. It is the understanding of the PSG that casing and wellhead structures are POC expeditures. Other engineering development could be SOC. The PSG will need to request that the SAS prioritize engineering development for long-term monitoring and borehole system integration as soon as possible. It was recognized that such prioritization is under the purview of the new Engineering Development Panel.

Action Item 0502-7: Chair to engage SAS on priortitizing observatory engineering development needs.

8. Presentation: Randy Norman – Sandia Laboratories (NantroPSG2_App_P)
Randy Norman (High-Temperature Electronics Geothermal Research Dept. Sandia National Labs) gave a presentation to the PSG members that focused on issues that need to be considered when planning instrumentation for deep-fault monitoring. Utilizing experienced gained in a variety of operations, Norman discussed laboratory and well testing protocols, evaluation criteria, and instrument components and design.

9. Task Flow
Shin'ichi Kuramoto handed out several charts of Work Flow and Data requirements for Riserless and Riser drilling for NanTroSEIZE.and asked for comments and input from the PSG.

The PSG noted several modifications including:

(1) making the responsibility of acquiring offset well data a responsibility of both the IO and proponents,
(2) including the timing of SAS and OPCOM meetings,
(3) better definition the mechanism/responsibility for seismic interpretation (e.g., IO? Proponent?),
(4) refinement of EPSP input (current draft has too much iteration for riserless and not enough for riser drilling
(5) deletion of 3D survey needs for reference sites and
(6) building flow chart to include subsequent "stages"

The PSG the discussed the need to begin to integrate this flow chart with the "stages" described in Item 6 above and for the implementing organizations (USIO and JPIO) to begin to develop time estimates for the initials stages.

Action Item 0502-8: Chair to request time estimates for Stage 1 operations to be prepared for the June29-30 2005 Operations Task Force meeting in Edinburgh

10. Next meeting
The next meeting of the PSG will most likely be held in the early Fall of 2005 (after the June Operations Task Force meeting but prior to the Fall SPC meeting). By this time the Operations Task Force will have developed a number of scheduling scenarios for FY07

and FY08 and have gone through a series of iterations with SPC to optimize these scenarios. The PSG will then be able to meet and discuss issues that may need to be forwarded to SPC for their consideration when the vote to approve the final operations schedule.

The location is not known at this time.

Report of the NanTroSEIZE PSG

Sante Fe, New Mexico February 24-25, 2005

Appendix A

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NanTroSEIZE PSG#2 Meeting Agenda

- **Review Action Items from October 2004 PSG meeting**
- **Updates from SAS/IOs/Proponents**
- **Mandate Approval (Janecek)**
- **Site-by-Site Scoping (Tobin, Kinoshita, Underwood)**
- **Long-term monitoring planning (Kinoshita and Tobin)**
- **3D Seismic and Other Site Survey Activities (Kuramoto, Kinoshita, Tobin)**
- **Sites and Order of Drilling Operations**
- **Other Items**
- **Review Action Items**
- **Next Meeting -(location, date, participants)**
- **Adjourn**

Agenda Items (continued)

1. **Review Action Items from October 2004 PSG meeting**

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7. Designate scientists to work with eng. for geo-prediction for drilling (Tobin, Kinoshita, Kuramoto)
8. Explore task force for IODP Observatory science (Janecek)
9. PSG Task Forces (Tobin, Kinoshita)

Agenda Items (continued)

2. **Updates from SAS/IOs/Proponents**

–Brief updates on the items as they pertain to issues related to NanTroSEIZE drilling (e.g., operations, scheduling, drilling, ship status, etc).

a. Operations and Program Plan Updates **(Janecek)**
b. Proposal 603-C, 603-D Update **(Tobin and Kinoshita)**
c. SAS Update **(Becker)**
d. Chikyu Update **(Kuramoto)**
e. JOIDES Resolution and SODV updates **(Klaus)**

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Agenda Items (continued)

3. **Mandate Approval (Janecek)**

A draft mandate will be discussed, modified, and approved by PSG core members.

Agenda Items (continued)

4. **Site-by-Site Scoping (Tobin, Kinoshita, Underwood)**

The objective of this agenda item is to make sure that all PSG members (both engineering and science side) fully understand what is proposed. Review each proposed site one by one, including revisions to planned penetration depth discussed at the last PSG. Basic information includes:

- Depth of penetration
- Predicted geology, major targets
- Coring, downhole measurements plan
- Long-term observatory objectives as proposed
- Scientist prediction of possible challenges, hazards (e.g., hydrate, overpressure)

After this basic information is compiled, discussed and agreed upon, we can begin an *initial site scoping* including :

- Riser or riserless drilling requirements?
- How much casing is necessary?
- Special wellhead requirements for long-term?
- Other engineering considerations?

Agenda Items (continued)

5. **Long-term monitoring planning (Kinoshita and Tobin)**

The major objective of this agenda item for the PSG to agree on a way forward and designate a subset of PSG members (and other experts) to more fully develop the long-term NanTroSEIZE observatory plans.

Topics might include:

- Who is responsible for which parts of observatories (e.g., IO?, Scientists?)
- Are non-riser and riser hole observatories to be handled differently? How?
- How can we coordinate and target engineering efforts?
- Task force members?
- How to integrate this NanTroSEIZE observatory group into the IODP Observatory Task Force to be started by IODP-MI?

Agenda Items (continued)

6. 3D Seismic and Other Site Survey Activities

The objective for this agenda item is to provide the PSG with an update on positive developments toward 3D seismic acquisition, and decide how to move forward on negotiating contract, and parameterize survey to preserve both science and engineering (hazard survey) goals of acquisition.

- 3D survey – parameters and coordinating negotiations (CDEX, IFREE, NSF/U.S. proponents)

- Other site surveys update

- Interaction with SSP/EPSP and site survey databank

Agenda Items (continued)

7. Sites and Order of Drilling Operations (ALL)

The JOIDES Resolution will be off-contract in Jan 2006 and a new riserless vessel will most likely not be on-line until mid FY07 at the earliest. Thus it appears that the first ship to the NanTroSEIZE area will be *Chikyu*.

The goal here is to decide the operational order for drilling operations and what might be potential scheduling scenarios.

Agenda Items (continued)

8. Other Items

9. Review Action Items

10. Next meeting

Location
Date
Host
Participants

PSG Mandate

GENERAL PURPOSE

The general purpose of the Project Scoping Group (PSG) is to plan and coordinate a Complex Drilling Project (CDP) in conjunction with the Implementing Organizations (IOs) and IODP-MI and to oversee the implementation of this multi-year, multi-expedition, and (potentially) multi-platform project. The PSG ensures that the scientific objectives defined in the CDP proposal and by the Scientific Advisory Structure (SAS) are respected and works closely with IODP-MI, the IOs, and SAS to maintain maximum planning flexibility in order to respond to unfolding scientific developments in a timely and cost-efficient manner.

GENERAL PURPOSE (continued)

Specific functions of a Project Scoping Group include:

- Assisting IODP-MI, the Implementing Organizations, and expedition Co-Chief scientists in the design of detailed implementation plans for all CDP phases.
- Integrating the proposed drilling and instrumentation plan with the overall scientific effort as described in the CDP proposal and approved by the SAS.
- Defining, developing, and coordinating long-term observatory monitoring plans for the holes drilled during the project.
- Developing and overseeing critical paths and gateways to achieve scientific objectives specified in the CDP proposal and approved by the SAS.
- Coordinating data output from disparate drilling and non-drilling related activities.
- Assisting IODP-MI and IOs with Education and Outreach activities
- Reporting progress toward implementation of the CDP to the IODP management (via the IODP-MI Operations task force) on a regular basis

MODE OF OPERATION

A. Initiation of Scoping Group:
A Project Scoping Group is constituted by IODP-MI through its Operations Task Force (formerly known as OPCOM). IODP-MI's Operation Task Force may implement a Project Scoping Group for any expedition at any stage of implementation it deems necessary. Normally, for CDP proposals, the Operations Task Force may initiate a PSG after the Science Planning Committee (SPC) designates a proposal to be a Complex Drilling Project and subsequently recommends that the Operations Task Force evaluate the level of scoping (if any) required for the project.

MODE OF OPERATION (cont)

B. Reporting
A Project Scoping Group reports directly to the IODP-MI Operations Task Force. The PSG will supply reports and updates on the status of its activity at each regularly scheduled IODP-MI Operations Task Force meetings but the PSG may be requested to supply reports more frequently as deemed necessary by the Operations Task Force.

The Operations Task Force Chair will be the formal PSG liaison to the SAS. The Operations Task Force Chair, in practice, may designate specific PSG members as liaisons to SAS committees.

MODE OF OPERATION (cont)

C. Meeting Size:
In order to keep the meetings productive, efficient, and cost effective, Project Scoping Group meeting size will generally consist of the 7-8 Core Members, 2-5 IO technical representatives, 1-2 SAS representatives and 1-3 Guests.

D. Meeting Frequency:
Meetings will be held 3-4 times/yr or as deemed necessary by the Operations Task Force.

MODE OF OPERATION (cont)

E. Membership:
A Project Scoping Group consists of (1) Core Members, (2) Implementing Organization Technical Representatives, (3) Science Advisory Structure Representatives, and (4) Guests.

MODE OF OPERATION (cont)

Core Members
A group of 7-8 members, consisting of 3-4 community scientists (generally proposal proponents), 1-2 Implementing Organization representatives, and IODP-MI representatives comprise the permanent members of the PSG. These Core Members provide the long-term institutional memory for the PSG and are responsible for the primary planning and coordination of the CDP and carrying it through the multi-year, multi-leg, and multi-platform project. These Core Members determine the specific agendas for each PSG meeting.

The scientists will be selected from a pool of scientists recommended by the SAS. The Chair of the PSG will be the IODP-MI Manager of Operations.

MODE OF OPERATION (cont)

Implementing Organization Technical Representatives.
Implementing Organization representatives with specific technical, operational, or engineering expertise for the IODP platforms that will be utilized during the project will participate in the PSG. These IO representatives will provide a primary point of contact for PSG Core Members in need of specific technical or operational expertise about the IO platform capability. The number and expertise of the IO representatives attending each meeting will depend on the agenda developed by the PSG Core Members.

MODE OF OPERATION (cont)

Science Advisory Structure representatives
Science Advisory Structure representatives are invited to attend each PSG meeting. Normally, 1-2 SAS members attend the meetings.

Guests
Guests are invited by the Core Members (subject to approval by the PSG Chair) when the PSG needs specific technical, operational, engineering or scientific input not provided by the Core Membership, IO technical representatives, or Science Advisory Structure representative(s).

"Normal" Program Plan Development

• SPC	Ranking of Proposals
• OPCOM / SPC	Develop schedule options
• SPPOC	Approval of schedule
• Lead Agencies	Budget Guidance
• IODP-MI / IO's	Develop APP
• SPPOC/BoG/NSF	Approval of APP

Operations Update-- FY05 Program Plan

Date	Entity	Action taken
Aug 02	iPC	Five MSP Programs Ranked
Sep 03	SPC/OPCOM	Global Ranking of All Programs/ FY05 Schedule (Oct-May)
Jan 04	NSF	Lead Agency Budget Guidance
Mar 04	SPC	Tahiti Sea Level Program sent to OPCOM
Apr 04	OPCOM	Tahiti Scheduled as FY05 MSP/ Minor JR schedule change
May 04	IODP-MI / IOs	FY05 Program Plan developed
Jun 04	NSF/ SPC	New Budget Guidance for FY05 / New Rankings to OPCOM
Jul 04	SPPOC	Approve original FY05 Program Plan
Sep 04	OPCOM	New FY05 & FY06 Schedule
Oct 04	SPC	Approval of new FY05 Schedule/FY06 Science Program
Nov 04	IODP-MI/JA	Develop FY05 PP addendum
Nov 04	NSF	New Budget Guidance for JR operations
Dec 04	SPPOC/OPCOM	Revision and Approval of New Schedule
Jan 04	IODP-MI/JA	Develop Revised Program Plan Addendum
Feb 05	IODP-MI	Revised Program Plan Addendum to NSF

Operations Update-- FY05/06 Schedules

Expedition	Port (Origin)	Dates	Co-Chief Scientists
Riserless			
North Atlantic Climate 1	St John's	22 Sep - 17 Nov	Channell, Sato
Oceanic Core Complex 1	Ponta Delgada	17 Nov '04 – 8 Jan '05	Blackman. John
Oceanic Core Complex 2	Ponta Delgada	8 Jan – 2 Mar	Ildefonse, Ohara
North Atlantic Climate 2	Ponta Delgada	2 Mar – 26 Apr	Kanamatsu, Stein
Porcupine Carb Mounds	Dublin	26 Apr – 31 May	TBN
Gulf of Mex Hydrogeology	Mobile	31 May – 6 Jul	TBN
Superfast Spreading 1	Balboa	6 Jul – 24 Aug	TBN
Cascadia	Balboa	24 Aug – 7 Oct 7	TBN
Monterey	Victoria	7 Oct– 24 Nov 8	TBN
Superfast Spreading 2	Balboa	24 Nov – 8 Jan '06	TBN
Demobilization	Galveston	8 Jan – 31 Jan	TBN
MSP			
Tahiti		June-Aug	Camoin, Iryu

FY06 Planning-(continued)

• Jan	Lead Agency Budget Guidance
• Mar	OPCOM/SPC -Schedule MSP?
• Apr	IODP-MI Develop APP
• Jun	SPPOC Approval
• Aug	NSF Approval
• Oct	Start of FY06 Operations

FY07 Planning

- Mar 05 SPC Ranking (All platforms)
- Jun 05 OPCOM develop schedule options
- Oct 05 SPC Approval of schedule options
- Dec 05 SPPOC Approval of Plan
- Jan 06 Lead Agency Budget Guidance
- Apr 06 IODP-MI Develop APP
- Jun 06 SPPOC Approval
- Aug 06 NSF Approval
- Oct 06 Start of FY07 Operations

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Report of the NanTroSEIZE PSG

Sante Fe, New Mexico February 24-25, 2005

Appendix B

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Drilling the Megathrust:
The Nankai Trough Seismogenic Zone Experiment

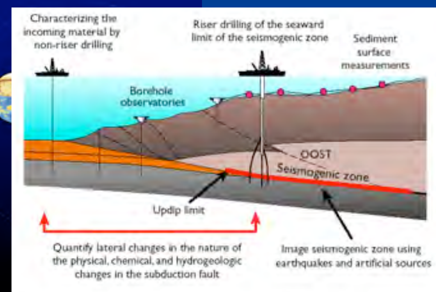
Co-Chief Project Scientists
Masa Kinoshita — *JAMSTEC - Japan*
Harold Tobin — *New Mexico Tech - USA*

Gaku Kimura — *University of Tokyo - Japan*
Mike Underwood — *University of Missouri - USA*
Pierre Henry — *CNRS - France*
Juichiro Ashi — *Un. of Tokyo ORI - Japan*
Demian Saffer — *Un. Of Wyoming - USA*
Kiyoshi Suyehiro — *JAMSTEC - Japan*
Kevin Brown — *Scripps IO - USA*
Elizabeth Screaton — *University of Florida - USA*

…and 25 other co-proponents who have contributed time and ideas

1

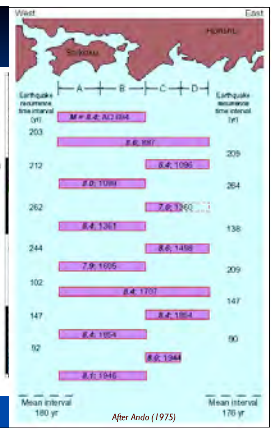
IODP
Integrated Ocean Drilling Program



2

Why the Nankai Trough?

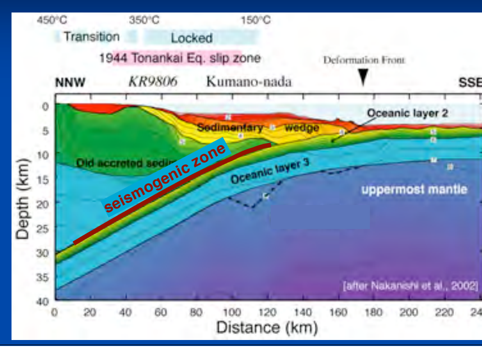
- Long record of frequent great earthquakes (M ~ 8.0+)
- Strongly locked
- Well-imaged faults = well-defined drilling targets
- Up-dip end of seismogenic zone within reach of *Chikyu*
- Proximity to Japan for monitoring, allied studies



After Ando (1975)

3

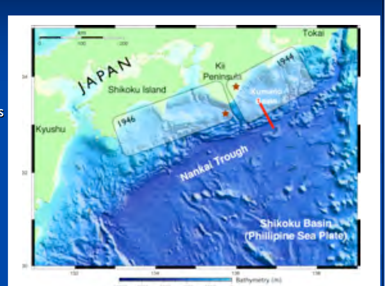
Subduction zone structure and interplate seismogenic zone: up-dip and down-dip limits



4

Nankai Trough Subduction Zone: 1940s Tsunamigenic Earthquakes

- ~ 15 Ma Philippine Sea plate subducts ~ 40 mm/yr
- Last 2 M8+ earthquakes were fairly typical
  - 1944 (To-nankai)
  - 1946 (Nankai-do)
- 1946 a bit larger, but complex source suggests several sub-events occurred



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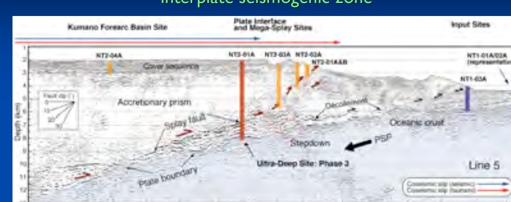
NanTroSEIZE objectives:
Building a *distributed observatory* spanning the up-dip end of the interplate seismogenic zone



Seismic data from Park et al., Science, 2002

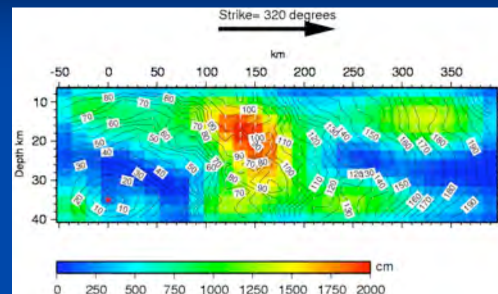
- 8 proposed drilling sites, to depths from ~500 to ~5500 m below the seafloor
  - Previous ODP depth record is ~2200 m
- Allied geophysical, seafloor studies
- Sampling, logging, downhole testing, and long-term monitoring are all important

Why is drilling necessary?

- Fundamental physics of faulting remains poorly understood in many ways, especially:
  - Processes of rupture nucleation, growth, propagation, and arrest
  - Stable vs. unstable behavior (aseismic vs. seismic slip)
  - Energy budget of fault slip (radiated energy, fracture energy, frictional heating)
- Key parameters for rate and state friction, energy budget of rupture propagation can only be measured by in situ access
  - Pore fluid pressure, stress magnitudes and variations, thickness of slip zone, strength and elastic properties of fault zone and wall rock
- Drilling results provide ground truth information for inferences based in remote geophysical sampling
- Drilling provides access to make new geophysical, geochemical measurements
  - Fault zone trapped waves, near-field seismology, seismic velocity and anisotropy variations as proxies for stress, evidence for fluid content and migration

7

Great earthquake size and effects may be governed by nature of large-slip zones, not by nucleation character



Sumatra-Andaman 12-26-04

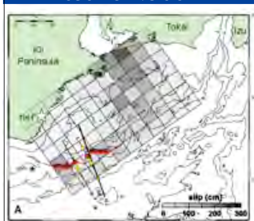
Slip inversion by Ji Chen, CalTech

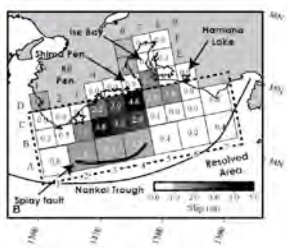
8

Seismic and tsunami waveform inversion indicates substantial up-dip slip on shallow asperity

Proposed deep drill sites are located in this high-slip zone

Seismic inversion | Tsunami inversion





Ichinose et al., JGR, 2003

Baba et al., in press

9

Objectives of NanTroSEIZE

- Document the material properties and state of the plate boundary fault system at several P-T and lithology conditions, testing hypotheses for stable vs. unstable frictional behavior.
- Investigate partitioning between seismic vs. aseismic processes on the main plate boundary, through monitoring of seismicity, borehole strain, and pore fluid pressure.
- Test whether there are interseismic temporal changes in state – including possible earthquake precursory signals.
- Calibrate observations in the broader geophysical volume surrounding the boreholes.

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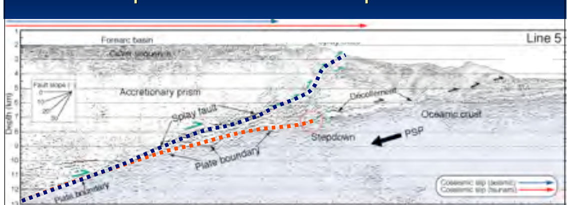
Deep Penetration MCS Depth Section



Park et al., *Science*, 2002

- Décollement step-down to at or near basement-sediment interface
- Prominent active splay fault (out-of-sequence-thrust) forms Kumano basin; may have been locus of much or all of 1944 shallow tsunamigenic slip

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Phased Drilling Plan: Progressive Access to an Evolving Fault System

Seismic data from Park et al., *Science*, 2002

Ongoing: Geophysical/Geologic Characterization

Phase I: Reference drilling: Incoming section and crust, borehole observations

Phase II: Splay fault mechanics and slip history (to ~ 3500 m)

Phase III: Plate interface drilling and instrumentation (to ~ 6000 m)

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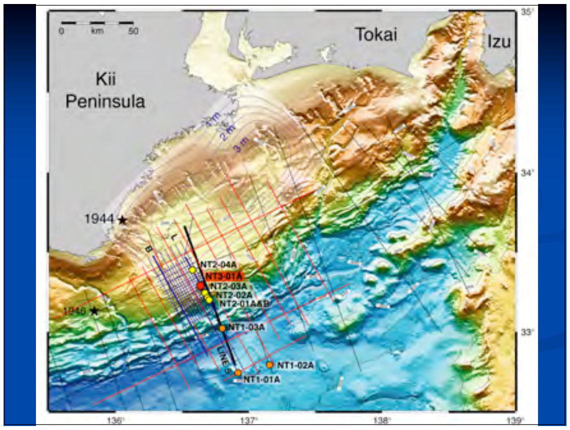
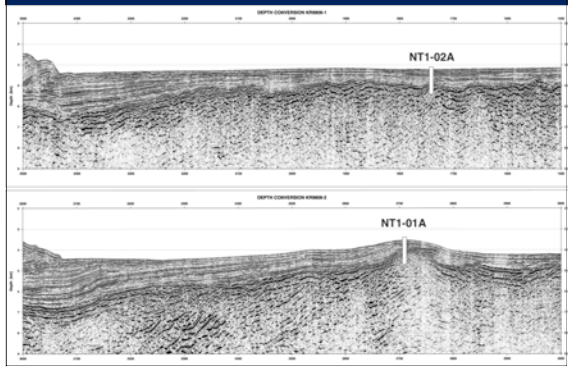
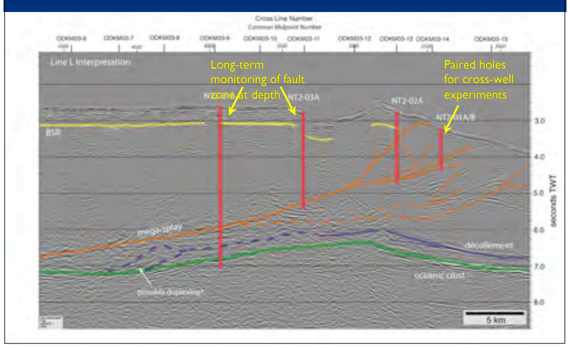


Phase 1: Sites NT1-01A and -02A



Mega-Splay and Plate Interface Proposed Sites



Specific Objectives

- Obtain samples of faults and surrounding environment
  - Characterize lithology, structure, elastic and mechanical properties, porosity, permeability, pore fluid chemistry, microbiology
- Characterize the near-borehole environment
  - Geophysical logging
  - Active testing for pore fluid pressure, stress, hydrogeologic properties (permeability, storage)
- Monitor the borehole environment over time
  - Passive and active source seismology
  - Strain and tilt
  - Pore fluid pressure
  - Temperature
  - EM field

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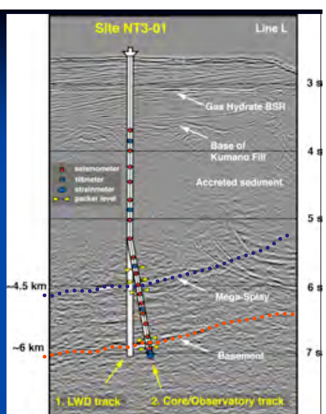
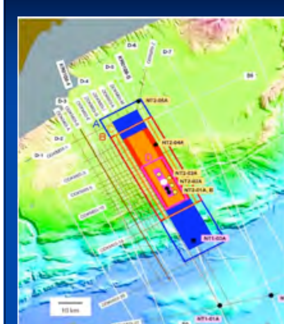
Megathrust Site Observatory: Fault Zone Monitoring

- Pilot Hole coring/logging 0 - 1000 m
- Deepen Hole to ~ 6000 m TD
  - Heavy use of LWD, limited coring
  - Nested casing strings from 30" to 9 5/8"
- Sidetrack above mega-splay and core 2nd crossing of faults
- Active hydrological/stress experiments (DST, MDT)
- Completion - Install Observatory (proposed):
  - Multiple perforated, packer isolated intervals
  - Multiple sensor strings
  - Long-term fluid sampling (?)
  - Real-time data transmission via proposed sea floor cable network



Planned 3-D Seismic Reflection Survey



- Objectives: Image splay fault and decollement zone architecture, seismic attributes across up-dip limit
- Japan - US collaboration,to be funded by MEXT (CDEX, IFREE), NSF
- Acquisition tentatively planned for March-April 2006
- To be acquired through a commercial contract, with modern industry methods

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Organization of NanTroSEIZE CDP

CDP = Complex Drilling Project, a category defined by SAS

- *Overview Proposal* is 603-CDP
  - Lead Proponents G. Kimura and H. Tobin
- 603-A: Inputs Sites
  - Lead Proponents M. Underwood and J. Ashi
- 603-B: Splay Fault Sites
  - Lead Proponents M. Kinoshita, K. Brown, P. Henry, and D. Saffer
- 603-C: Deep Plate Boundary Site
  - Lead Proponents H. Tobin, K. Suyehiro
- 603-D: Non-riser site Observatories
  - Lead Proponents E. Screaton and M. Underwood

Project Scoping Group set up by OpCom on recommendation from SPC in June, 2004

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Present Status of NanTroSEIZE CDP Proposals

- Most of the proposed project is now through complete IODP scientific review
- CDP, Phases 1 and 2 ranked #2 and #3 globally by SPC in 2004, Phase 3 going to March SPC for ranking
- Awaits availability of drilling ship(s)

For more information:

http://ees.nmt.edu/nantroseize

One of Chikyu's thrusters. Kochi University undergrads for scale. 20

Report of the NanTroSEIZE PSG

Sante Fe, New Mexico February 24-25, 2005

Appendix C

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2nd PSG in Santa Fe

CDEX Statement

Shin'ichi Kuramoto

(Science Service GL)

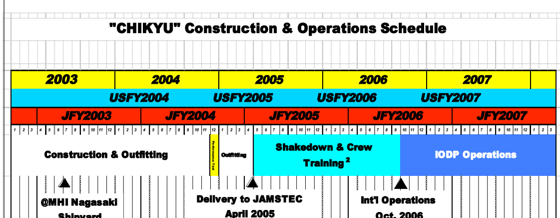
Feb. 24-25, 2005

A Proposed New Name Instead of PSG

PROject Management & Planning Team

PROMPT

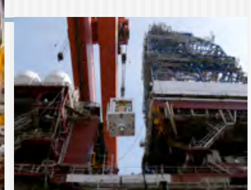
Schedule and Status



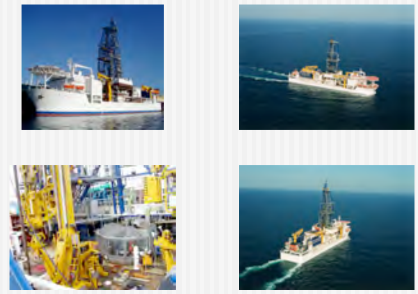
Construction of "CHIKYU"

Dec. > Sea Trial (3-8 & 18-25)

Jan.-Feb. > more inspections, Sci. Equ. Inst.



Getting a final Inspection



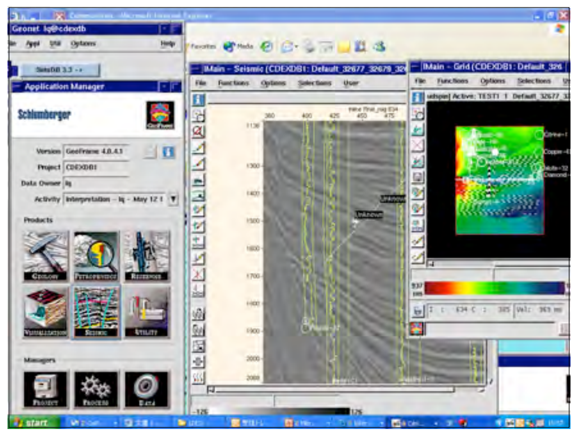
Data Management (SIO_7)

(Science Information from 7 Oceans)

- **Core Data Management**
  - **J-CORES (JAMSTEC Core Systematics)**
- **Site Survey Data Management**
  - **DEXIS (Deep Earth Exploration Information Service)**

Visit our web site:

http://sio7.jamstec.go.jp/

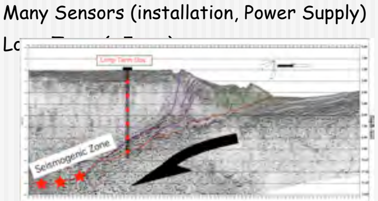


Long-Term Borehole Observatory

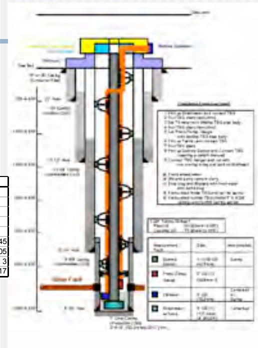
NanTroSEIZE Long-Term Borehole Observatory

ISP recommends

- Deep Hole (~7 km)
- High Temperature (~150 ℃)
- Pressure Control (Wellhead)
- Many Sensors (installation, Power Supply)
- L



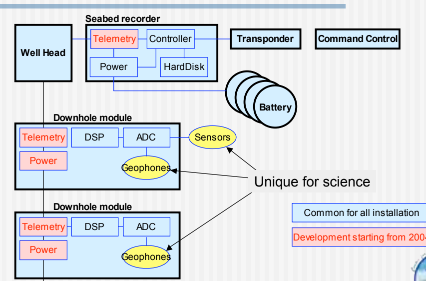
System Overview



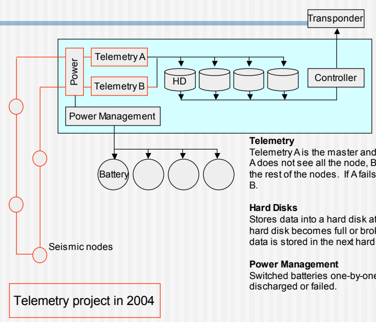
Data rate & power consumption

Data volume and power	Seismic	Tiltmeter	Strainmeter	P/T	Total
Word length [bits]	24	24	24	24	
Power per level [W]	2	0.45	0.1	0.54	
Number of levels	8	1	1	1	
Components per level	3	2	1	2	
Sampling [samples/s]	250	10	10	10	
Data rate [kbps]	144	0.48	0.24	0.48	145
Data per year [Gbytes]	567.648	15.13728	7.56864	15.13728	605
No. of 240GB HD	2.3652	0.063072	0.031536	0.063072	3
Downhole power [W]	16	0.45	0.1	0.54	17

Typical Monitoring System



Redundant Telemetry



Telemetry
Telemetry A is the master and B is a backup. If A does not see all the node, B tries to access the rest of the nodes. If A fails, B will take over B.

Hard Disks
Stores data into a hard disk at a time. If the hard disk becomes full or broken, then the data is stored in the next hard disk.

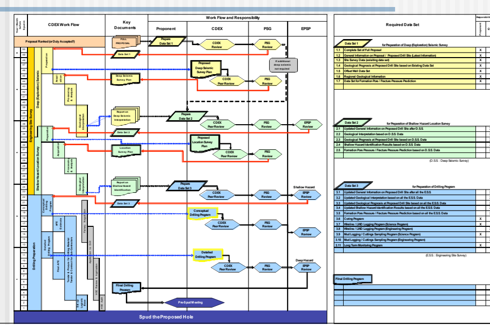
Power Management
Switched batteries one-by-one as a battery is discharged or failed.

Schedule

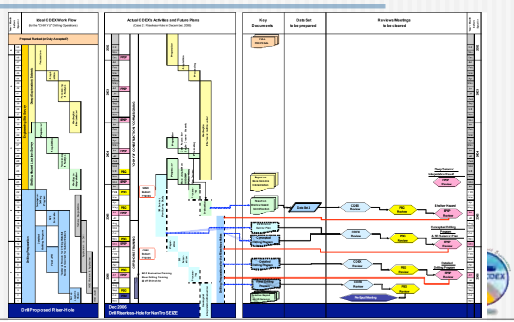
- 2003: Pre-Study
- 2004: Telemetry Design & Mock-up Experiment
- 2005: Recording System, Data Transfer System
- 2006-07: System Integration and Construction

Task Flow

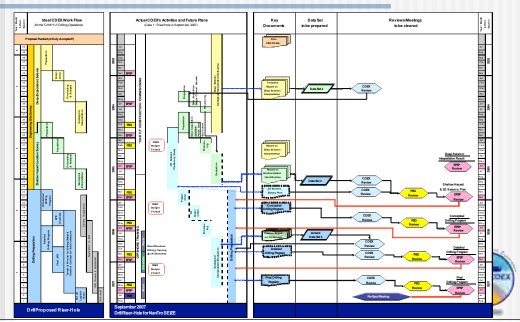
Task Flow (general)



Task Flow (shortest case)



Task Flow (case 2)



Report of the NanTroSEIZE PSG

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Appendix D

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IODP USIO Riserless Vessel Schedule[1]

Cruise*		Port (Origin)	Dates[2,3]	Total Days (Port/Sea)	Days at Sea (Transit[4]/Ops[5])	Co-Chief Scientists	Alliance Contact(s)
Oceanic Core Complex 1	304	Ponta Delgada	17 November '04 – 8 January '05	52 (5/47)	7/40	Donna Blackman Bertrand Ildefonse	TAMU: J. Miller
Oceanic Core Complex 2	305	Ponta Delgada	8 January – 2 March	53 (5/48)	7/41	Benoit Ildefonse Yasuhiko Ohara	TAMU: J. Miller LDEO: H. Delius
North Atlantic Climate 2	306	Ponta Delgada	2 March – 26 April	55 (5/50)	5/45	Toshiya Kanamatsu Rüdiger Stein	TAMU: C. Zarikian LDEO: S. Higgins
Porcupine Carbonate Mounds	307	Dublin	26 April – 31 May[6]	35 (6/29)	19/10	Jean-Pierre Henriet TBN	TAMU: R. Malone LDEO: T. Williams
Gulf of Mexico Hydrogeology	308	Mobile	31 May – 6 July	36 (5/31)	11/20	Peter Flemings TBN	TAMU: T. Davies LDEO: TBN
Superfast Spreading 1	309	Balboa	6 July – 24 August	49 (5/44)	6/38	Susumu Umino Jeffrey Alt	TBN
Cascadia	311	Balboa	24 August – 7 October[7]	44 (5/39)	17/22	Michael Riedel	TAMU: R. Malone LDEO: G. Guerin
Monterey	312	Victoria	7 October – 24 November[8]	49 (6/43)	15/28	Charles Paull TBN	TAMU: A. Klaus LDEO: G. Myers
Superfast Spreading 2	313	Balboa	24 November – 8 January '06[9]	44 (5/39)	17/22	TBN	TBN
Demobilization		Galveston	8 January – **31 January 2006**	23 (23/0)	0/0	TBN	TBN

Notes: 7 JANUARY 2005

[1] Schedule reflects an approved science program, but final endorsement by lead agencies is pending.

IODP, USIO Phase II vessel (MREFC Program)

TIMELINE	4 Feb 05	Proposals due from ship operators
	Feb-Mar	Proposal evaluation
	Apr	Ship inspection tours
	May	Begin negotiations

FUNDING Currently a 3-year funding model
FY05 $15M (allocated)
Proposed budget to Congress
FY06 $58M (requested)
FY07 $40M (projected)

Current Project Plan targets ship operations by end of FY07

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Report of the NanTroSEIZE PSG

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Appendix E

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PROJECT ~~SCOPING GROUP~~MANAGEMENT TEAM? MANDATE

GENERAL PURPOSE

The general purpose of the Project ~~Scoping Group~~Team ~~(PSG)~~ is to plan and coordinate a Complex Drilling Project (CDP) in conjunction with the Implementing Organizations (IOs) and IODP-MI animal of OpTAF and to oversee the implementation of this multi-year, multi-expedition, and (potentially) multi-platform project. The ~~PSG~~ Project Team ensures that the scientific objectives defined in the CDP proposal and by the Scientific Advisory Structure (SAS) are respected and works closely with IODP-MI, the IOs, and SAS to maintain maximum planning flexibility in order to respond to unfolding scientific developments throughout the lifespan of the CDP in a timely and cost-efficient manner.

Specific functions of a Project Scoping Group include:

- Assisting IODP-MI, the Implementing Organizations, and expedition Co-Chief scientists in the design of detailed implementation plans for all CDP phases.
- Integrating the proposed drilling, downhole measurement, and instrumentation plan with the overall scientific effort as described in the CDP proposal package and approved by the SAS.
- Defining, developing, and coordinating long-term observatory monitoring plans for ~~the holes drilled during~~ the project.
- Developing and overseeing critical paths and gateways to achieve the scientific objectives specified in the CDP proposal and approved by the SAS.
- Coordinating data output from disparate drilling and non-drilling related activities.
- Assisting IODP-MI and IOs with Education and Outreach activities
- Reporting progress toward implementation of the CDP to the IODP management (via the IODP-MI Operations task force) on a regular basis
- Providing expedition staffing advice to national offices.

MODE OF OPERATION

A. Initiation of Scoping Group:

A Project Scoping Group is constituted by IODP-MI through its Operations Task Force (formerly known as OPCOM). IODP-MI's Operation Task Force may implement a Project Scoping Group for any expedition at any stage of ~~implementation~~ its development ~~it~~ deemed ~~s~~ necessary. Normally, for CDP proposals, the Operations Task Force may initiate a PSG after the Science Planning Committee (SPC) designates a proposal to be a Complex Drilling Project and subsequently recommends that the Operations Task Force evaluate the level of scoping (if any) required for the project.

B. Reporting
A Project Scoping Group reports directly to the IODP-MI Operations Task Force. The PSG will supply reports and updates on the status of its activity at each regularly scheduled IODP-MI Operations Task Force meetings but the PSG may be requested to supply reports more frequently as deemed necessary by the Operations Task Force.

The Operations Task Force Chair will be the formal PSG liaison to the SAS. The Operations Task Force Chair, in practice, may designate specific PSG members as liaisons to SAS committees.

C. Meeting Size:
In order to keep the meetings productive, efficient, and cost effective, Project Scoping Group meeting size will generally consist of the 7-8 Core Members, 2-5 IO technical representatives, 1-2 SAS representatives and 1-3 Guests.

D. Meeting Frequency:
Meetings will be held 3-4 times/yr or as deemed necessary by the Operations Task Force.

E. Membership: **(maybe put this before "Meeting Size")**
A Project Scoping Group consists of (1) Core Members, (2) Implementing Organization Technical Representatives, (3) Science Advisory Structure Representatives, and (4) Guests.

Core Members
A group of 7-8 members, consisting of 3-4 community scientists (generally proposal proponents), 1-2 Implementing Organization representatives, and IODP-MI representatives comprise the permanent members of the PSG. These Core Members provide the long-term institutional memory for the PSG and are responsible for the primary planning and coordination of the CDP and carrying it through the multi-year, multi-leg, and multi-platform project. These Core Members determine the specific agendas for each PSG meeting.

The scientists will be selected from a pool of scientists recommended by the SAS. The Chair of the PSG will be the IODP-MI Manager of Operations.

Implementing Organization Technical Representatives.
Implementing Organization representatives with specific technical, operational, or engineering expertise for the IODP platforms that will be utilized during the project will participate in the PSG. These IO representatives will provide a primary point of contact for PSG Core Members in need of specific technical or operational expertise about the IO platform capability. The number and expertise of the IO representatives attending each meeting will depend on the agenda developed by the PSG Core Members.

Science Advisory Structure representatives
Science Advisory Structure representatives are invited to attend each PSG meeting. Normally, 1-2 SAS members attend the meetings.

Guests
Guests are invited by the Core Members (subject to approval by the PSG Chair) when the PSG needs specific technical, operational, engineering or scientific input not provided by the Core Membership, IO technical representatives, or Science Advisory Structure representative(s).

NanTroSEIZE Project Management Team Mandate

The purpose of the NanTroSEIZE Project Team is to plan and coordinate the implementation of the 603-CDP Complex Drilling Project (CDP), in conjunction with the Implementing Organizations (IOs) and IODP-MI. The Project Team is tasked with ensuring that the scientific objectives, as defined in the CDP proposal and by the Scientific Advisory Structure (SAS), are respected to the fullest possible extent while responding flexibly to the changing scientific and operational conditions encountered through the lifespan of the CDP in a timely and cost-efficient manner. The NanTroSEIZE Project Team will work closely with the Operations Task Force and Implementing Organizations to develop detailed operational plans.

Specific functions of the NanTroSEIZE Project Scoping Group include:

- Assisting IODP-MI, the Implementing Organizations, and expedition Co-Chief scientists in the design of detailed implementation plans for all CDP phases.
- Integrating the proposed drilling and instrumentation plan with the overall scientific effort as described in the CDP proposal package and approved by the SAS.
- Defining, developing, and coordinating long-term observatory monitoring plans for the project.
- Developing and overseeing critical paths and gateways to achieve the scientific objectives specified in the CDP proposal and approved by the SAS.
- Coordinating data output from disparate drilling and non-drilling related activities.
- Assisting IODP-MI and IOs with Education and Outreach activities.
- Reporting progress toward implementation of the CDP to the IODP management (via the IODP-MI Operations task force) on a regular basis.

Report of the NanTroSEIZE PSG

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Appendix F

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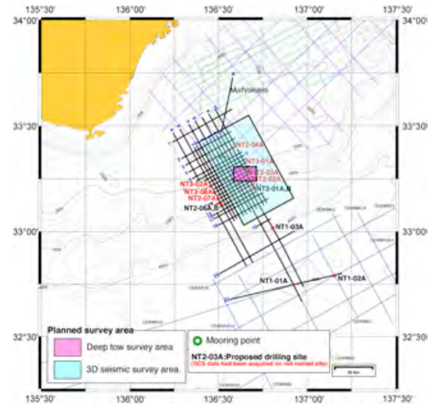
Kumano-Nada 3-D Survey
-@NanTro SEIZE PSG#2-

T.Yohroh / CDEX
Feb.24&25,2005
@Santa Fe
U.S.A.

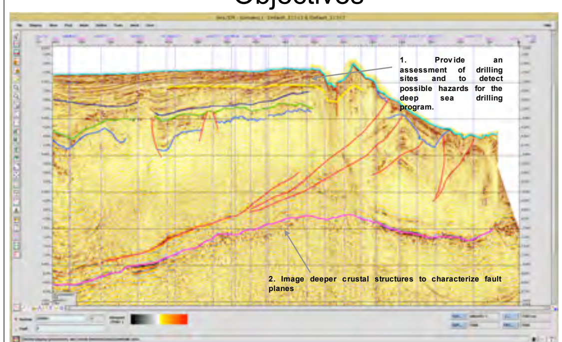


Objectives

- 1. Better Delineation of the Splay Faults
- and Other Tectonic Frameworks.

- 2. To Acquire the High-resolution Data
- to Detect the Possible Hazards before
- Drilling.

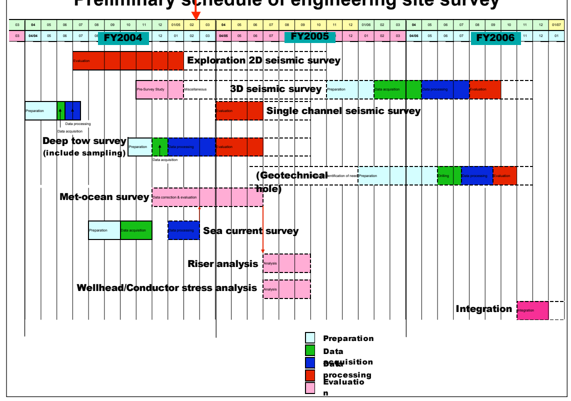
Objectives



History of the "Nankai-3D" Progress

- * June,2004 "Nankai-3D" Workshop @ Rice
- Univ., Houston
- * Oct.,2004 PSG#1 @CDEX,Jamstec,
- Yokosuka
- * Dec.,2004 SED(Survey Evaluation of Design)
- to WesternGeco ordered by CDEX
- * January, 2005 SED Presentation by Tim
- Brice/WGC @ CDEX, Yokohama
- * Jan.,2005 SED Report to IFREE, Hawaii Univ.,
- UTIG & ORI by CDEX
- * Feb.,2005 PSG#2@SantaFe

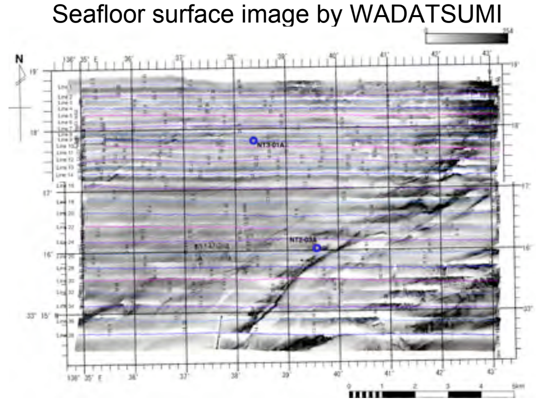
Preliminary schedule of engineering site survey



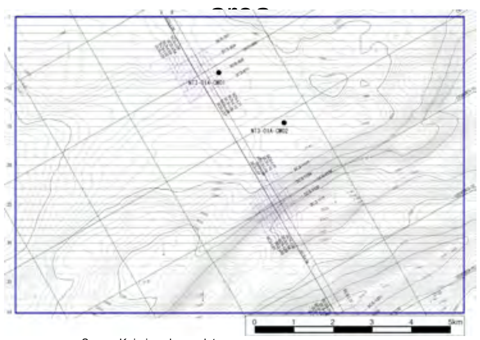
調査海域

JAMSTEC

Seafloor surface image by WADATSUMI

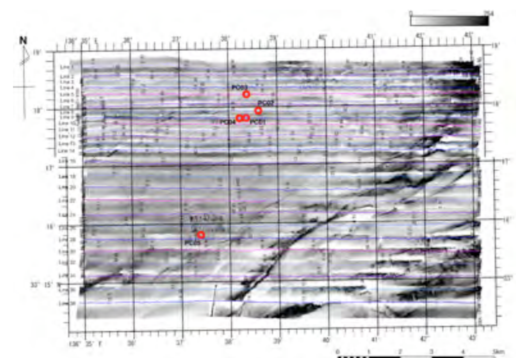


Seafloor topography of the survey area

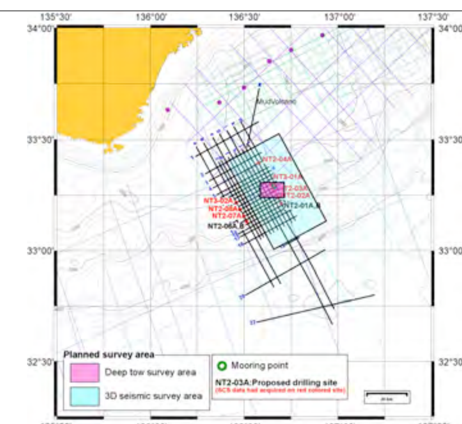


Source:Kairei seabeam data

Planned PC locations

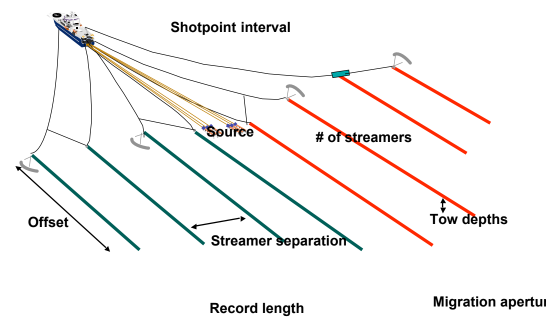


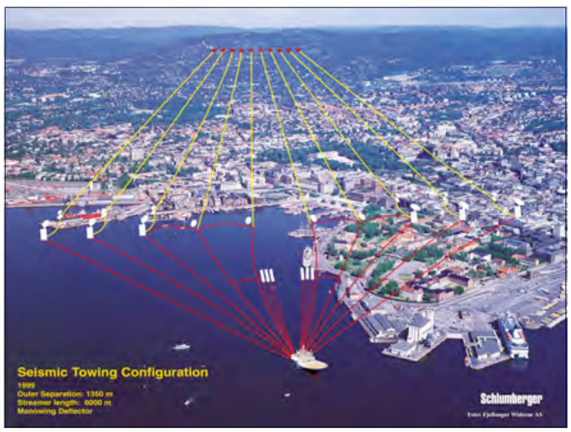
"Kumano-nada 3-D" Parameters



Acquisition and processing

- Acquisition parameters
  - Offset
  - Spatial sampling (streamer spacing)
  - Record length
  - Shotpoint interval
  - Migration aperture
  - Source
    - Volume, tow depths (source, cable)
- Sampling requirements
  - Sampling in shot, receiver and CMP domains
  - Demultiple

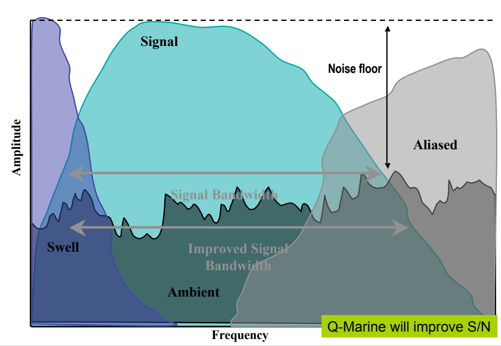




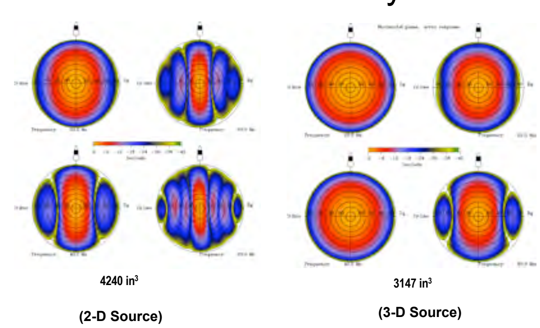
Recommended acquisition parameters

- Sample interval 2ms
- Number of cables 8*
- Cable length 8000m**
- Group interval 12.5m(640ch.)
- Cable separation 100m
- Shotpoint interval 37.5m
- Subsurface bin size Inline 12.5m, Crossline 25m(about 106 fold)
- Record length 13 seconds
- Source Single 3147 in^3 array
  - Source depth 6m, cable depth 7m
- Migration aperture 3000m***
  - * Or maximum operationally possible
  - ** See Section 3.2.1 Maximum offset
  - *** For full imaging of the shallow section

Noise and bandwidth

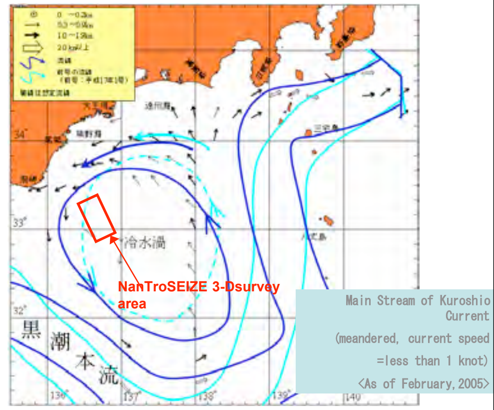


Source directivity



Required Logistics

- 1.Capable 3-D Seismic Vessel
- (Hopefully Time Sharing with Other Users)
- 2.Chase Boats (2-3)
- 3.Fishery Negotiation (2 Marine Advisers
- onboard)
- 4.QC Personnel Onboard
- * Acquisition,Head(1-2)
- * Navigation(1-2)
- * Processing(1-2)
- * Technical Auditing at the Start of the Survey?
- 5.Insurance



Project Scheme

- 1.IFREE,NSF&CDEX
- 2.How to put NSF fund in the Project?
- *NSF→Hawaii Univ.→Jamstec(CDEX)?
- 3.Agreement with the Seismic Contractors
- Who will be Operator of the 3-D Project?
- 4.Timing of Commitment to the Contractor
- * Acquisition Parameters
- * Survey Area (before start of the survey)
- 5.How to Deal with Processing &
- Interpretation of the Data?
- 6.Funding?

Schedule Proposed

- 1.Specs. for Internal Bidding by CDEX
- 2.Pre-commitment to a Contractor for the
- Usage of 3-D Vessel in early 2006(in
- Summer).
- 3.Data Processing Issues.
- 4.Finalization of the Agreements between
- the Partners.
- 5.Contract to a Contractor
- 6.Mobilization of the 3-D Vessel

The Next Gathering Proposed
in
S.E. Asia
to
Determine 3-D Seismic Parameters
before
Pre-Commitment to the Seismic
Contractor

END

Report of the NanTroSEIZE PSG

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Kumano-Nada 3-D
Sum-up PSG#2

Present Status & Future

- 1. NSF,IFREE & CDEX will make funding for the 3-D project :
- NSF about 2.5-3.0 MM $
- IFREE 1
- CDEX 1 + 3.5? +
- 2. Timing of the 3-D Survey --- early 2006
- 3. The most critical thing is Mob-demobilization cost
- of 3-D vessel --- We will pursue the sharing with other
- user(s) in Japan. "Academic Discount"?
- 4. 3-D vessel ←PGS, Veritas, WesternGeco and/or CGG
- * Contact with WesternGeco has been proceeding.
- * CDEX-Jamstec will be engaged in negotiation with the contractors
- toward the agreement.
- 5. Data processing is another issue --- time constraint, cost(budget)
- 6. G & M shipboard measurement at extra cost?
- 7. Input from the colleagues of U.S.major oil companies?
- 8. Next specific gathering in Singapore, May?(organized by CDEX)

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Appendix H

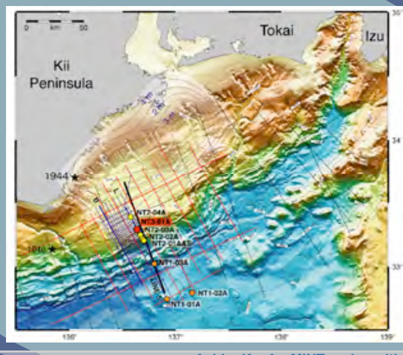
MINT:
MeBo drilling & **I**n situ-measurements in the **N**ankai **T**rough accretionary prism

Achim Kopf, Heiner Villinger, Tim Freudental
Research Centre Ocean Margins (RCOM)
Bremen University --- GERMANY

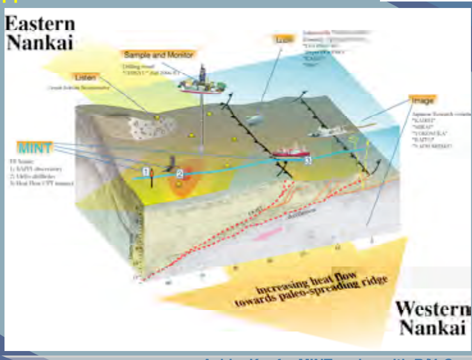
Masa Kinoshita, Kiyoshi Suyehiro, Juishiro Ashi
JAPAN

Kevin Brown, Annette Deyhle, Mike Tryon
USA

Study area



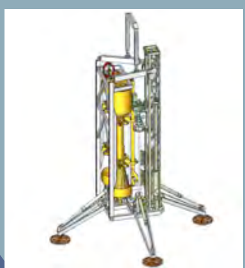
MINT approach in the NanTroSEIZE context



Approach

1) MeBo drilling (including CPT)
2) SAPPI monitoring
3) CAT Meter
4) Heat flow probes
5) Free fall-CPT
6) Gravity coring
7) other suggestions ?

MeBo (**Me**eresboden-**Bo**hrgerät, or seafloor operated drill)

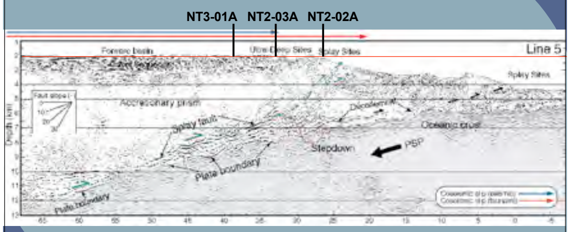


MeBo (2): onshore drilling test & drillcores

MeBo (3): spec's

- 50 m penetration (will be 100 m in Phase 2)
- push coring and rotary coring modes (changeable depending on subbottom sed./rock met during drilling)
- 80 mm core diameter (50 mm diameter in Phase 2)
- CPT (cone penetration testing) optional to drilling
- lithologies from soft seds to carbonates, basalt, or other hard rocks
- water depth 2000 m (4000 m in Phase 2)
- tolerable slope angle 15° (hydraulic legs compensate for inclination)
- tolerable seafloor roughness 1 m (between legs)
- shipped in standard 20' containers (one for the drill, one for the winch, one for the control unit, telemetry, etc.)

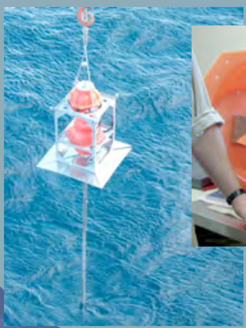
MeBo targets along line 5



Achim Kopf – MINT cruise with R/V *Sonne*
NanTroSEIZE PSG meeting, Santa Fe/NM, 24.-25. Feb. 2005

SAPPI (1)

Satellite-linked Autonomous Pore Pressure Instrument



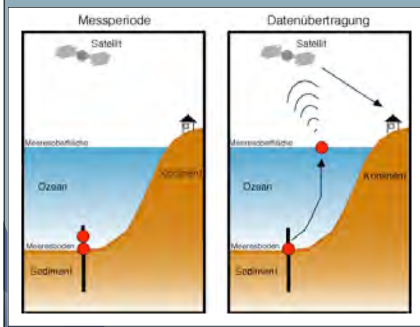
Electronics & Data storage

Deployment

Achim Kopf – MINT cruise with R/V *Sonne*
NanTroSEIZE PSG meeting, Santa Fe/NM, 24.-25. Feb. 2005

SAPPI (2)

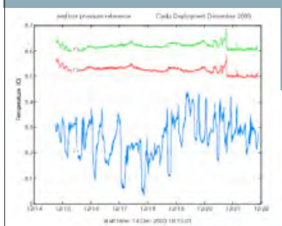
Satellite-linked Autonomous Pore Pressure Instrument

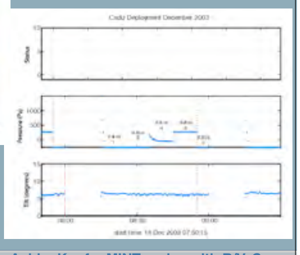


Sketch illustrating measurement and data transfer modes

Achim Kopf – MINT cruise with R/V *Sonne*
NanTroSEIZE PSG meeting, Santa Fe/NM, 24.-25. Feb. 2005

Example: Preliminary pore P / T data from a mud volcano off Gibraltar

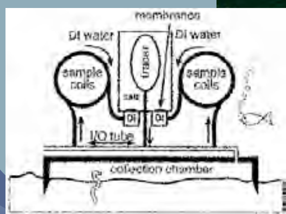




Achim Kopf – MINT cruise with R/V *Sonne*
NanTroSEIZE PSG meeting, Santa Fe/NM, 24.-25. Feb. 2005

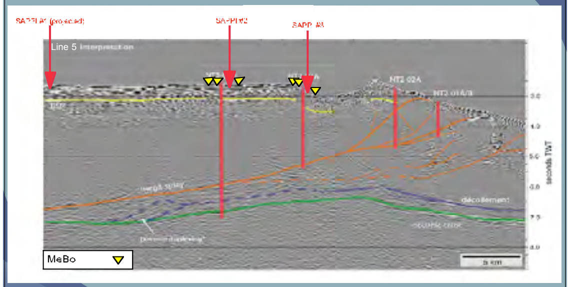
In situ-measurements during MINT:

CAT meters
(SIO, K. Brown/M. Tryon)



Achim Kopf – MINT cruise with R/V *Sonne*
NanTroSEIZE PSG meeting, Santa Fe/NM, 24.-25. Feb. 2005

Profile line 5



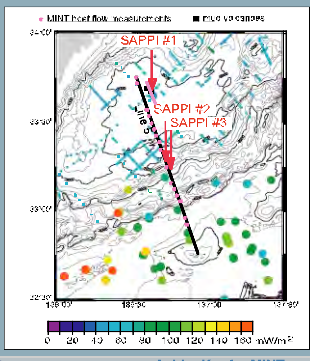
In situ-measurements during MINT:

Heat flow probes, Bremen Univ. (H. Villinger)

3 m lance

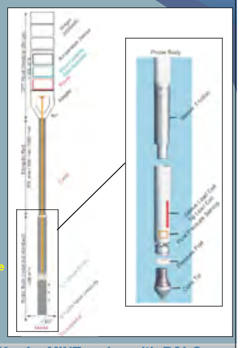
6 m lance

Additional heat flow sites during MINT



Marine Free fall-CPT (cone penetration testing)-Lance:

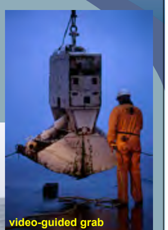
- Tip with a standard-15cm^2-onshore CPT
- 12 V power pack (autonomous)
- Data acquisition 200 Hz, Memory: SmartMedia
- Penetration depth modular from 1 m to 5 m (1m extension rods)
- monitored parameters: pore pressure, tip resistance and sleeve friction (as a function of sediment shear strength), temperature, tilt after deployment
- Acceleration sensor allows for 1cm resolution and better; range up to 5g
- weight 40 kg (1 m penetration) up to approx. 100 kg (5 m penetration)
- depth of penetration is controlled via the length (i.e. total number of rods and the modular weight set at the the head of the lance (one weight = 15 kg)
- present lance capable of 200 m water depth; modified pore pressure sensors and seals will be able to cope with 2500 m, and will be available in fall 2005



Other devices on board R/V Sonne

video-guided push corer

gravity cores



video-guided grab

... and:

- Multibeam
- Deep-towed video sledge
- MST track

Vessel: R/V Sonne

- MINT cruise scheduled for April 2006
- US or Japanese R/V will pick up CAT meters and SAPPI systems 12 months later

Discussion

- multiple cores needed with MeBo?
- what physical properties are required to plan casing design?
- who will sail leg 1, 2, or both?
- are there conflicts with other operations in the area, e.g. the anticipated 3D seismic reflection survey
- what other data would be desirable?
- do we have to feed the Site Survey Panel with more information?

- **other aspects I may have missed ???**

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Appendix I

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Site-by-Site Scoping Table

Site	Planned TD	Primary targets	Predicted Geology	Coring Requirement	Downhole Measurements Desired	Monitoring Desired	Potential Challenge/Hazard
NT1-01	570 mbsf	1. Lower Shikoku Basin facies 2. Basement	0-255 mbsf: Upper Shikoku Basin facies; hemipelagic mud and volcanic ash 255-470 mbsf: Lower Shikoku Basin facies; hemipelagic mud; boundary between USB and LSB not clearly defined 470-570: basalt	Continuous coring to TD	Full-suite of LWD logs, wireline sonic log and resistivity imaging log if possible. DST, VSP, CHDT-type tests. Drillstring packer tests. DVTP-P or Piezoprobe style temperature and pressure measurements in shallow seds.	1A. Screen basement for P, T 1B. Screen LSB sediment for P, T 2A. Osmosampler in basement 2B. Osmosampler in LSB sediment 2C. Seismometer and/or tilt meter	None
NT1-02	775-820 mbsf (depends on which seismic line is used to locate site)	1. Lower Shikoku Basin facies 2. Basement	0-290 mbsf: distal trench-wedge facies, trench-to-basin transition; fine sand to silt turbidites and hemipelagic mud 290-405 mbsf: Upper Shikoku Basin hemipelagic mud and volcanic ash 405-700 mbsf: Lower Shikoku Basin hemipelagic mud and thin turbidites 700-800 mbsf: basalt	Continuous coring to TD	Full-suite of LWD logs, wireline sonic log and resistivity imaging log if possible. DST, VSP, CHDT-type tests. Drillstring packer tests. DVTP-P or Piezoprobe style temperature and pressure measurements in shallow seds.	1A. Screen LSB sands for P, T 1B. Screen basement for P, T 2A. Osmosampler in LSB sands 2B. Osmosampler in basement 3. Seismometer and/or tilt meter	1. Possible unstable sands in LSB facies

Site	Planned TD	Primary targets	Predicted Geology	Coring Requirement	Downhole Measurements Desired	Monitoring Desired	Potential Challenge/Hazard
NT1-03	1600 mbsf ***(potential reduction to 800 – 1400 m??)***	1. Frontal thrust 2. Décollement 3. Lower Shikoku Basin facies beneath décollement	0-250 mbsf: Upper Shikoku Basin facies; lithified hemipelagic mudstone and volcanic ash 250 mbsf: frontal thrust 250-550 mbsf: Axial trench-wedge facies; uncemented turbidite sand, silt, hemipelagic mud 550-1100 mbsf: Outer trench-wedge facies, thins and fines down-section 1100-1400 mbsf: Upper Shikoku Basin facies, hemipelagic mudstone and volcanic ash ~1380 mbsf: Stratigraphic position of décollement, but not clearly defined 1400-TD: Lower Shikoku Basin turbidite facies, compacted sand and hemipelagic mudstone	Continuous coring to TD	Full-suite of LWD logs, wireline sonic log and resistivity imaging log if possible. DST, VSP, CHDT-type tests. Drillstring packer tests. DVTP-P or Piezoprobe style temperature and pressure measurements in shallow seds.	1A. Screen décollement for P, T 1B. Screen sands in underthrust for P, T 2A. Osmosampler in décollement 2B. Osmosampler in sands below décollement 3. Seismometer 4. Basement monitoring	1. Unstable hole conditions due to fractured and brecciated rock 2. Unstable sands beneath frontal thrust 3. Possible water overpressures in fault zone(s) 4. Possible overpressured sands beneath décollement 5. TD could be too deep to reach without casing and heavy mud

Site	Planned TD	Primary targets	Predicted Geology	Coring Requirement	Downhole Measurements Desired	Monitoring Desired	Potential Challenge/Hazard
NT1-04*	To be determined	Monitoring site for strain transients; signal quality improves as lithification increases; basement not required	0-650 mbsf: Axial to distal trench-wedge facies; uncemented sand, silt, hemipelagic mud 650-1600 mbsf: Upper to Lower Shikoku Basin deposits; facies boundary not well defined	Continuous coring to TD	Full-suite of LWD logs. Drillstring packer tests. DVTP-P or Piezoprobe style temperature and pressure measurements in shallow seds.	1. Screen trench-wedge sands for P,T 2. Screen LSB sands for P, T 3. Seismometer or tilt meter	1. Unstable sands in axial trench-wedge facies 2. Site is within axial channel-levee complex 3. Unstable sands in LSB turbidite facies
NT1-05* (alternate for NT1-04)	To be determined	Monitoring site for strain transients; signal quality improves as lithification increases; basement not required	0-380 mbsf: Axial trench-wedge facies; uncemented sand, silt, hemipelagic mud ~380-730 mbsf: Distal trench wedge and trench-to-basin transition; facies boundary not well defined ~730-900 mbsf: Upper Shikoku Basin facies; hemipelagic mud and volcanic ash ~900-1300 mbsf: Lower Shikoku Basin turbidite deposits; facies boundary not well defined	Continuous coring to TD	Full-suite of LWD logs. Drillstring packer tests. DVTP-P or Piezoprobe style temperature and pressure measurements in shallow seds.	1. Screen trench-wedge sands for P,T 2. Screen LSB sands for P, T 3. Seismometer or tilt meter	1. Unstable sands in axial trench-wedge facies 2. Unstable sands in LSB turbidite facies

Site	Planned TD	Primary targets	Predicted Geology	Coring Requirement	Downhole Measurements Desired	Monitoring Desired	Potential Challenge/Hazard
NT1-06* (alternate for NT1-02)	1090 mbsf	1. Lower Shikoku Basin facies 2. Basement	0-450 mbsf: Distal trench-wedge facies extends seaward into Shikoku Basin; basal transition not well defined ~450-600 mbsf: Upper Shikoku Basin facies; hemipelagic mud and volcanic ash; basal transition not well defined ~600-990 mbsf: Lower Shikoku Basin turbidite facies; uncemented sand and hemipelagic mud 990-1090 mbsf: basalt basement	Continuous coring to TD	Full-suite of LWD logs, wireline sonic log and resistivity imaging log if possible. DST, VSP, CHDT-type tests. Drillstring packer tests. DVTP-P or Piezoprobe style temperature and pressure measurements in shallow seds.	1A. Screen LSB sands for P, T 1B. Screen basement for P, T 2A. Osmosampler in LSB sands 2B. Osmosampler in basement 3. Seismometer and/or tilt meter	1. Unstable sands in distal trench-wedge facies 2. Unstable sands in LSB turbidite facies

Site	Planned TD	Primary targets	Predicted Geology	Coring Requirement	Downhole Measurements Desired	Monitoring Desired	Potential Challenge/Hazard
NT2-01	1085 mbsf	Characterization of splay fault under shallow condition	0-1085m: deformed turbidite and hemi-pelagic sediments 0.3 sec and 1 sec: Possible intersection with fault gouge and fracture zones	Continuous coring at 0-1085 m	LWD, wireline logging of sonic and resistivity images, density, etc. DVTP-P probe, wireline packer tests, VSP Cross-hole hydrologic exp.	1. Pressure and Temperature at the splay fault interval at 1 sec TWT. 2. Seismometer clamped near the splay fault 3. High-res. Tiltmeter and strainmeter cemented at bottom-hole (1100m)	1. Possible free gas although no BSR recognized yet 2. Unstable hole conditions due to fractured and brecciated rock, possibly with water overpressure at fault zones (0.3s and 1s)
NT2-02	685/2140 / 2190 mbsf	Characterization of splay fault under intermediate depth condition	0-2190m: deformed turbidite and hemi-pelagic sediments 685m, 2140m 2190 m: Possible intersection with fault gouge and fracture zones	Continuous coring at 0-2190 m	LWD, wireline logging of sonic and resistivity images, density, etc. DVTP-P probe, wireline packer tests, VSP		1. Possible free gas although no BSR recognized. 2. Unstable hole conditions due to fractured and brecciated rock, possibly with water overpressure at fault zones (685/2140/2190m)
NT2-03	3150 mbsf	Characterization of splay fault under deep condition	0-3150m: deformed turbidite and hemi-pelagic sediments Splay fault zone expected near the bottom but not confirmed in MCS profile	1. Continuous coring at 0-3150 m, or 2. Coring near the fault zones 3000m-TD	LWD, wireline logging of sonic and resistivity images, density, etc. DVTP-P probe, wireline packer tests, VSP	1. Pressure and Temperature at the splay fault interval at 1 sec TWT. 2. Seismometer clamped near the splay fault 3. High-res. Tiltmeter and strainmeter cemented at bottom-hole (1100m)	1. Possible free gas although no BSR recognized, possibly at 0.3sec bsf. 2. Unstable hole conditions due to fractured and brecciated rock, possibly with water overpressure at fault zones (~3150m)

Site	Planned TD	Primary targets	Predicted Geology	Coring Requirement	Downhole Measurements Desired	Monitoring Desired	Potential Challenge/Hazard
NT2-04	1300 mbsf ***(shallower depth proposed at PSG #1)***	Total history of the splay fault through continuous coring the Kumano basin sediments and pilot drilling for riser platform	0-1300m: Poorly consolidated basinal sediments, turbidites and hemi-pelagic (sands and muds) ~500m: Unconformity	Continuous coring at 0-1300m	LWD, wireline logging of sonic and resistivity images, density, etc. DVTP-P probe, wireline packer tests, VSP	Observatory at this site has been proposed on 603D	1. Possible free gas zone associated with Gas hydrate reflector at 0.3 sec bsf.

Site	Planned TD	Primary targets	Predicted Geology	Coring Requirement	Downhole Measurements Desired	Monitoring Desired	Potential Challenge/Hazar d
NT3-01	6200 mbsf ***(maybe closer to 5600 mbsf)(***	1. Base of Kumano Basin section 2. Mega-splay fault zone 3. Top of oceanic crust (presumed plate decollement fault zone)	0 – 1000 m: Poorly consolidated basinal sediments, turbidites and hemi-pelagic (sands and muds) 1000 – 3600 m: consolidated and deformed rocks of upper accretionary prism domain, mainly shales to sandstones 3600 – 6000 m: consolidated and deformed rocks of the lower accretionary prism domain, probably mostly shaly hemipelagic rock, with possible basalts, cherts, and sandstones 6000 – 6200 m: pillow basalt, volcaniclastic sediments,	1. Continuous coring from 0-1500 m 2. Intervals of coring TBA from 1500 - ~4000 m 3. Continuous coring from ~4000 to 5600 m. 4. Cuttings analysis throughout.	Full-suite of LWD logs, wireline sonic log and resistivity imaging log if possible (inside casing sonic?), DST, VSP, CHDT-type tests. Wireline packer tests after perforation. DVTP-P or Piezoprobe style temperature and pressure measurements in shallow seds.	1. Multi-level (up to 6) packer isolated perforated zones: basement, decollement, above decollement, beneath splay fault, splay fault, above splay fault. 2. Seismic array: 10 to 100 3 component short-period sensors clamped in borehole; 1 BroadBand at bottom of hole, cemented into place. 3. High-resolution tiltmeters at 4-5 levels spanning 2000 – 6000 mbsf. 4. Temperature measurements spanning fault zone intervals (3500? – 6000 mbsf) 5. Volumetric strainmeter cemented in outside casing at base of hole, (other levels if possible). 5. Fluid sampling over time (osmosamplers)? 6. EM conductivity/potenti	1. Possible free gas zone associated with Gas hydrate reflector at 0.3 sec bsf. 2. Possible unstable sands in upper 100s mbsf. 3. Unstable hole conditions due to fractured and brecciated rock, possibly with water overpressure at fault zones, at several depths 4. Sidetracking of hole for 2 or more fault crossings.

						al measurements?	

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Appendix J

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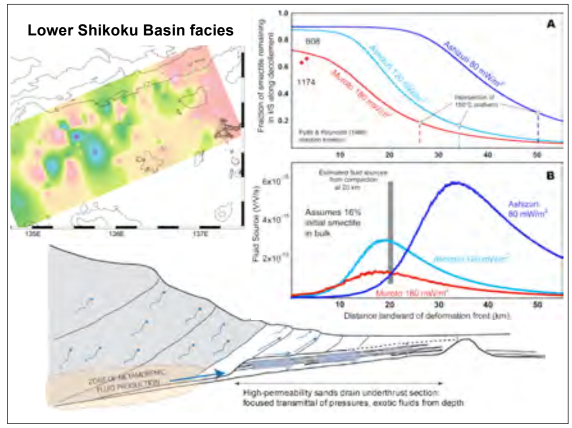
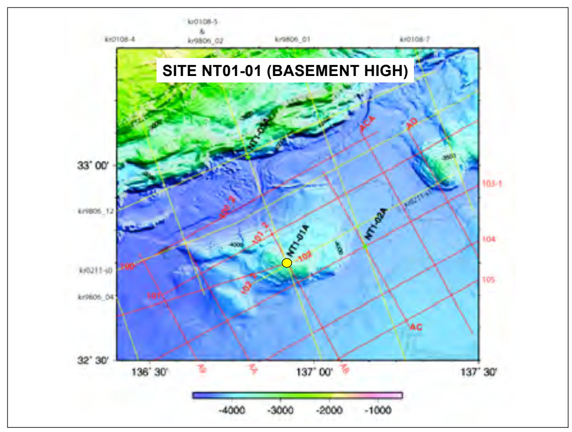
NanTroSEIZE:
The Nankai Trough Seismogenic Zone Experiment

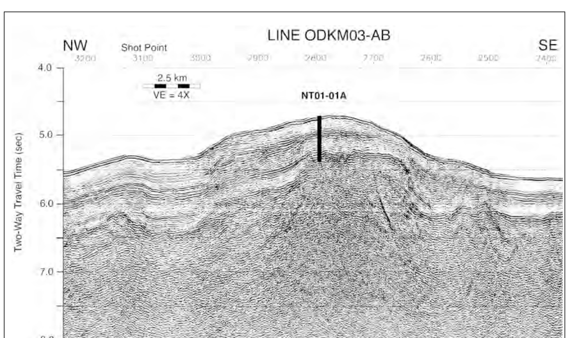
- Phase 1. Reference Sites
  - Michael Underwood (Univ. Missouri)
  - Juichiro Ashi (Univ. Tokyo)



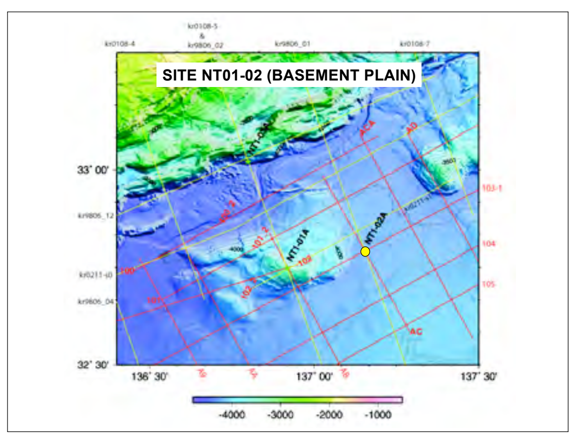
Ocean Reference Sites

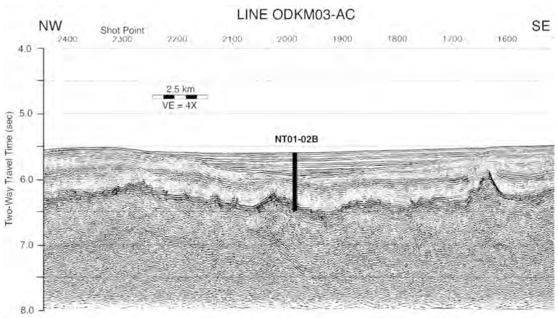
- How does basement structure affect **stratigraphic architecture** of the NE Shikoku Basin?
- How does the **physical hydrology** of Shikoku Basin respond to variations in turbidite sand bodies and basement structure?
- How do **fluids in igneous basement** affect subduction processes?
- How have system-wide patterns of sediment dispersal affected **sand-clay composition** within the trench wedge and Shikoku Basin, particularly on the NE side of the fossil spreading ridge?
- How do thermal structure and primary sediment/rock composition modulate **diagenesis, cementation,** and fluid-rock interactions?



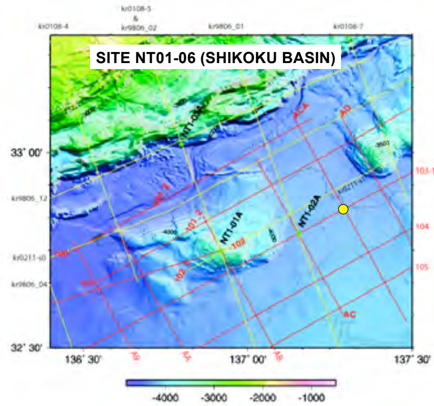


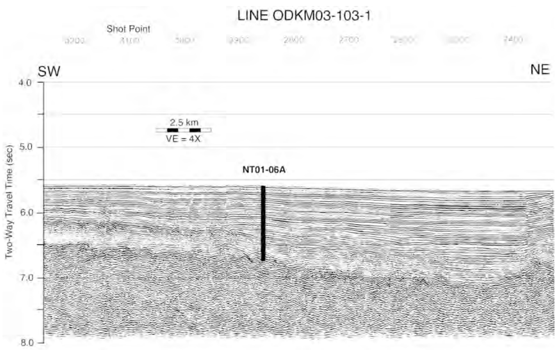
Top of LSB facies ≈ 255 mbsf (0.3 s)
Sediment-basalt interface = 470 mbsf (0.55 s)
Basement penetration = 100 m



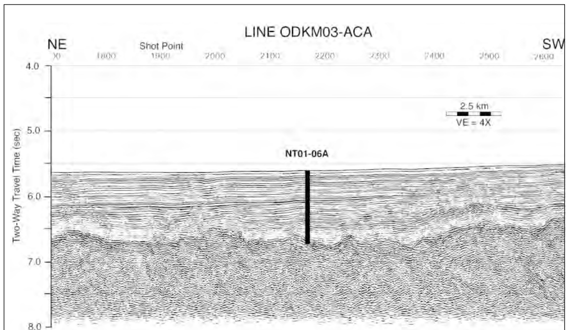


Top of LSB facies ≈ 405 mbsf (0.45 s)
Sediment-basalt interface = 675-720 mbsf (0.75-0.80 s)
Basement penetration = 100 m

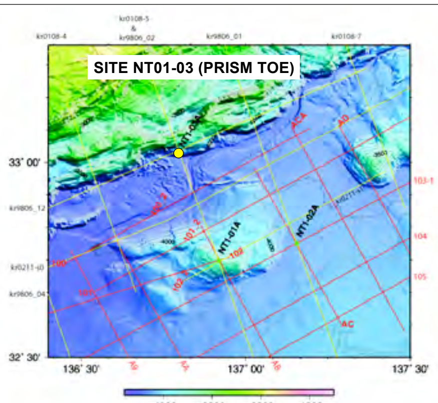




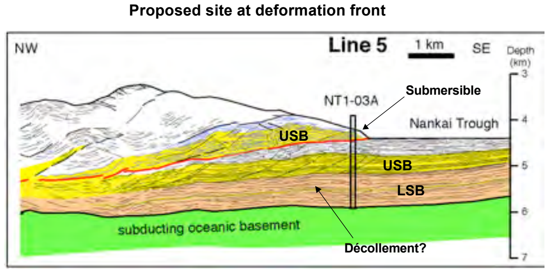
Top of USB facies ≈ 450 mbsf (0.5 s); top of LSB facies ≈ 600 mbsf)
Sediment-basalt interface = 990 mbsf (1.10 s)
Basement penetration = 100 m



Advantage: better LSB turbidite stratigraphy
Disadvantage: farther from NT01-01 for linked hydrogeology



Proposed site at deformation front



Questions:

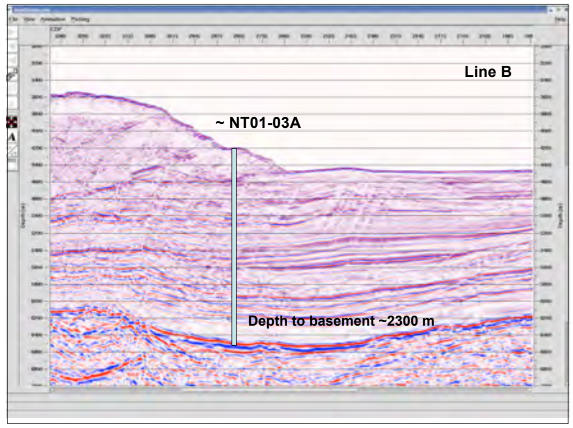
Along which stratigraphic interval does plate-boundary fault propagate?

Is frontal scarp the plate boundary or the first imbricate?

What processes govern early deformation?

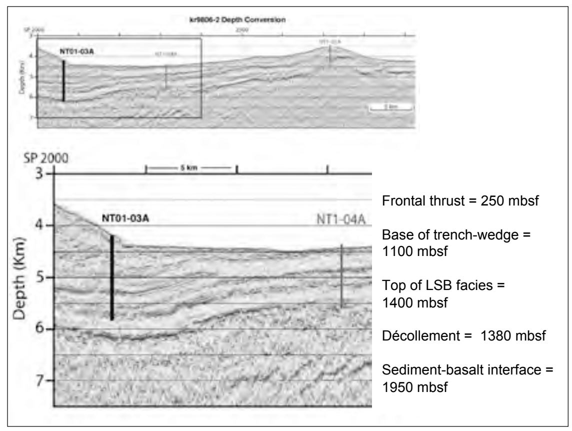
Toe of Accretionary Prism

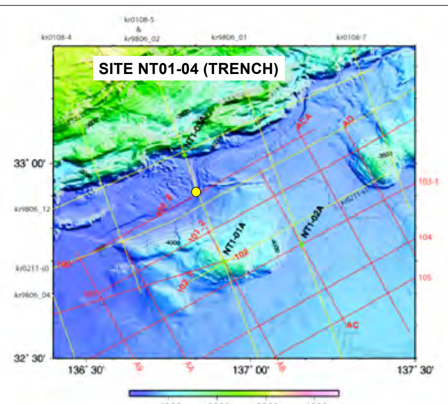
- Through which **stratigraphic interval** does the décollement propagate near the Kii deformation front?
- **Which factor(s)** control(s) the initial position of the fault tip at the prism toe, as well as the location of ramps and flats, and mechanical behavior throughout?
- Are strike-parallel changes from a “stronger” décollement to a “weaker” plate boundary influenced or controlled by inherited differences between subducting **basement highs** and subducting **basement plains**?
- How do intrinsic **geotechnical properties** (coeff. internal friction) balance against **effective stress** (excess pore pressure) above, within, and below décollement?

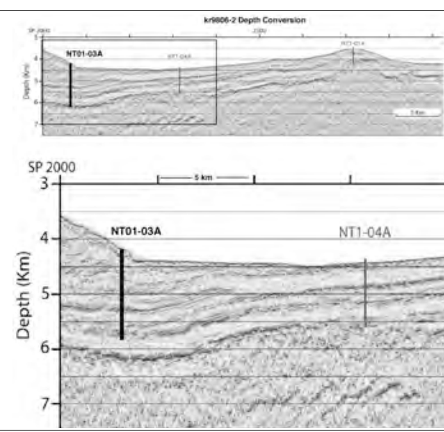


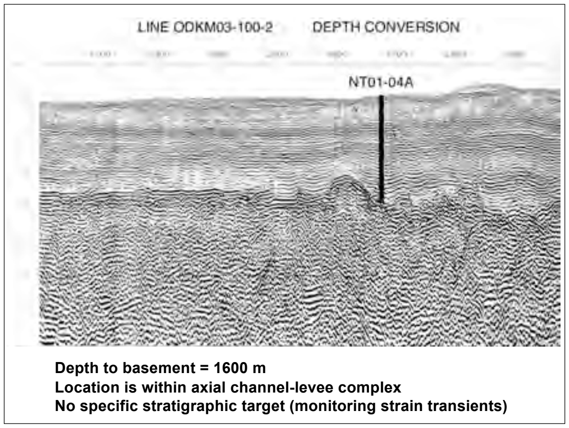
Depth section reprocessed by Greg Moore (Hawaii)

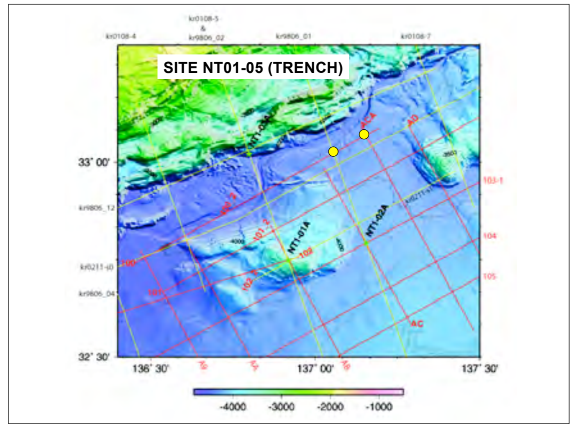
Crossing line is close enough - if we provide structure map.

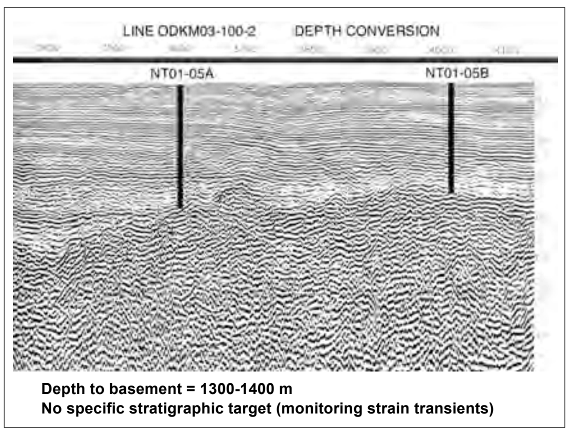


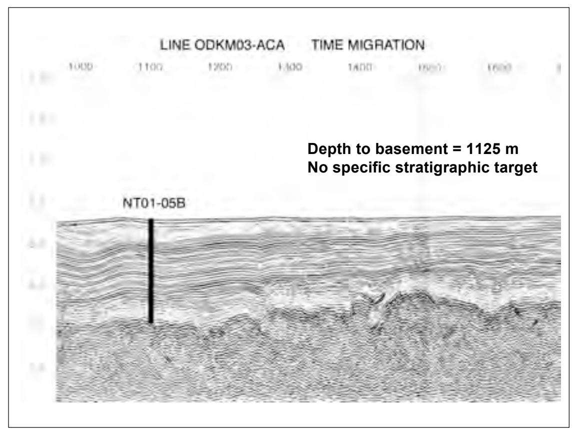





LINE ODKM03-100-2 DEPTH CONVERSION
NT01-04A
Depth to basement = 1600 m
Location is within axial channel-levee complex
No specific stratigraphic target (monitoring strain transients)


SITE NT01-05 (TRENCH)
33° 00'
32° 30'
136° 30'
137° 00'
137° 30'
-4000
-3000
-2000
-1000


LINE ODKM03-100-2 DEPTH CONVERSION
NT01-05A
NT01-05B
Depth to basement = 1300-1400 m
No specific stratigraphic target (monitoring strain transients)


LINE ODKM03-ACA TIME MIGRATION
Depth to basement = 1125 m
No specific stratigraphic target
NT01-05B

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Appendix K

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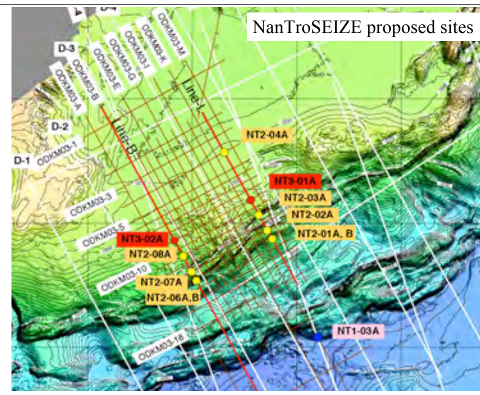
Safety Package for IODP Proposal 603B-Full2:

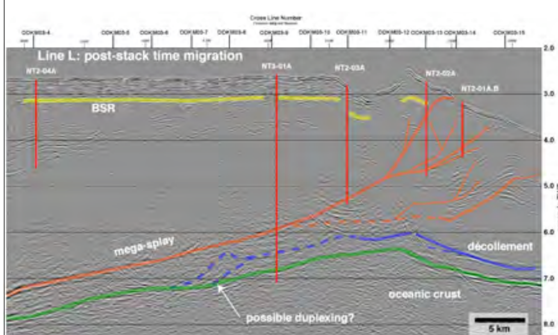
NanTroSEIZE Drilling and Observatory Phase 2
Mechanical and Hydrologic State of Mega-Splay Faults:
Implications for Seismogenic Faulting and Tsunami Generation

Masa Kinoshita

Harold Tobin

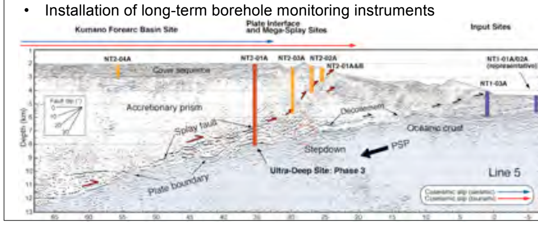
Mike Underwood





Scientific Objectives and Approaches

- Goal: to characterize the magnitude and nature of strain accumulation and slip along mega-splays off the Kii peninsula
- (1) Coring of 1 site in the Kumano Basin, focused on characterizing the tectonic history of the plate above the mega-splay faults
- (2) intersection of the active mega-splay fault system at three depths at ~1, ~2 and ~3.5 km below sea-floor, for downdip evolution study of fault material properties
- Installation of long-term borehole monitoring instruments



The M>8 events occur along the plate boundary fault and/or the mega-splay.

Princip… …oSEIZE

To acquire data bearing on and testing the following key hypotheses:

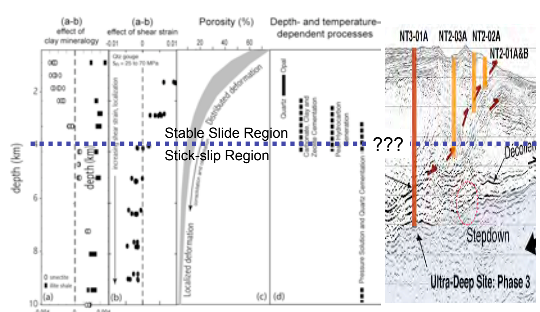
1. Systematic, progressive material and state changes control the onset of seismogenic behavior on subduction thrusts.

2. Subduction zone megathrusts are weak faults.

3. Within the seismogenic zone, relative plate motion is primarily accommodated by coseismic frictional slip in a concentrated zone.

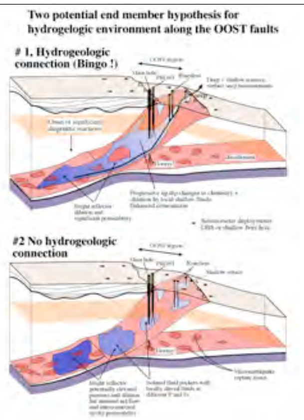
4. Physical properties, chemistry, and state of the fault zone change with time during the earthquake cycle.

Sampling and in-situ monitoring by the deep drilling is NECESSARY to test these hypotheses.

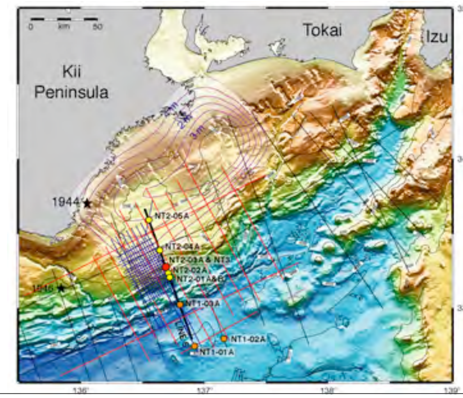


Conceptual diagram and laboratory data on processes responsible for the development of an up-dip onset of seismogenic behavior (the up-dip limit) in accretionary prism decollements and other fault zones.

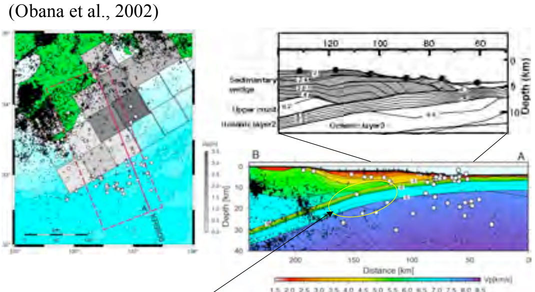
As the sediments and rocks of the fault system ride the subduction "conveyor belt" to the seismogenic zone, they encounter a progression of temperature and pressure dependent processes, leading to strengthening, embrittlement, and ultimately the onset of both strongly-localized deformation and



Why Line L instead of Line B?

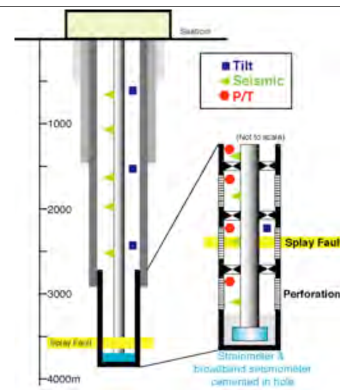


Micro Seismicity in the Nankai Trough off Kumano
(Obana et al., 2002)



Very little seismicity
Implication of 100% locked zone

Proposed plan for
the borehole long-
term monitoring
station



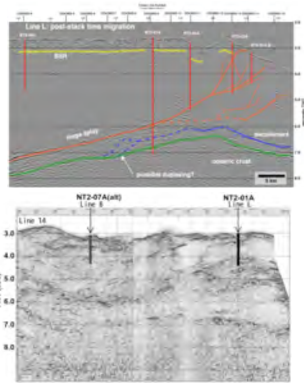
How do we test hypotheses ?

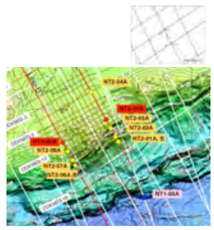
Hypothesis	Core analysis	Logging DHM	Observatory
1:MS is locked	Sedimentary sequence high-res.dating		Slip rate Strain accum.
2:MS is weak	Microstructural analysis Multi-holes	RAB DVTP-P VSP	Strain/Seism.
3:Prop. change w/P-T, become unstable	Microstructural analysis Multi-holes	RAB DVTP-P VSP	P/T
4:Hydrological connection	Permeability Fluid chem.	Porosity VSP	P/T
5:Prop. change w/time			All

Site-by-site description

Preliminary
Waiting for 3D data

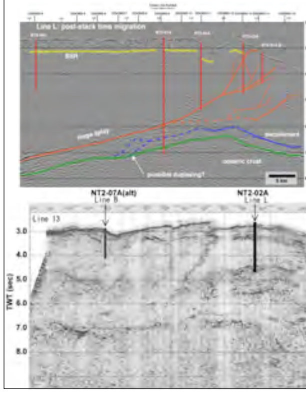
NT2-01A/B: **Shallow branch of splay fault**

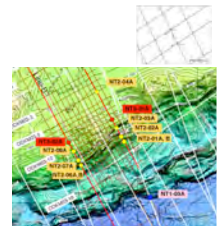




Crosslines	ODKM3-L and 14
Water Depth	2290 m
TD	1085 mbsf
Coring	Full
DM	LWD/DVTP/CORK/cross-hole exp.
Peff, btm	
Temp, btm	

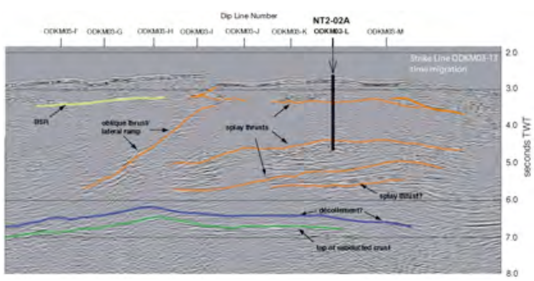
NT2-02A: **Intersecting the splay fault at 2 km bsf**



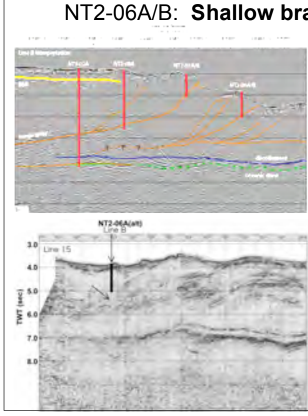


Crosslines	ODKM3-L and 14
Water Depth	2030 m
TD	685/2140 / 2190 mbsf
Coring	Full
DM	LWD/DVTP
Peff, btm	5-10 MPa
Temp, btm	40-60 degC

Interpretation at Line ODKM3-13 (by Harold Tobin)

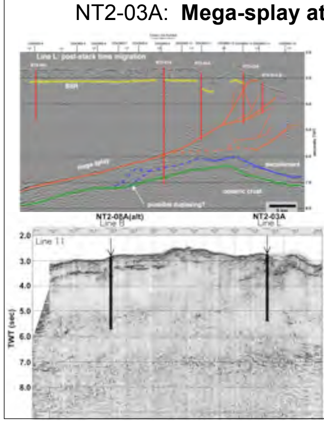


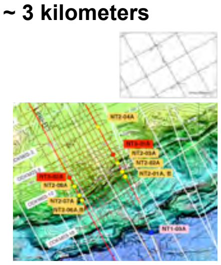
NT2-06A/B: **Shallow branch of splay fault**



Crosslines	ODKM3-B and 15
Water Depth	2990 m
TD	800 / 1055 mbsf
Coring	Full
DM	LWD/DVTP/CORK/cross-hole exp.
Peff, btm	
Temp, btm	

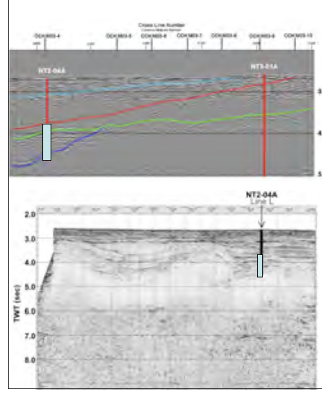
NT2-03A: **Mega-splay at ~ 3 kilometers**





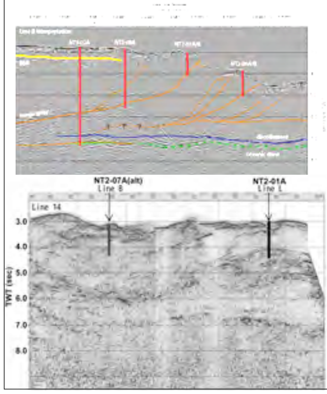
Crosslines	ODKM3-L and 11
Water Depth	2240 m
TD	3150 mbsf
Coring	Yes
DM	LWD/DVTP/Drill stem/RFT /Borehole observatory
Peff, btm	MPa
Temp, btm	degC

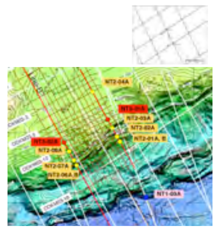
NT2-04A: **Kumano basin uplift history**



Crosslines	ODKM3-L and 4
Water Depth	1990 m
TD	1300 mbsf (formerly >2000 m)
Coring	Full
DM	LWD/DVTP/ CORK proposed
Peff, btm	
Temp, btm	

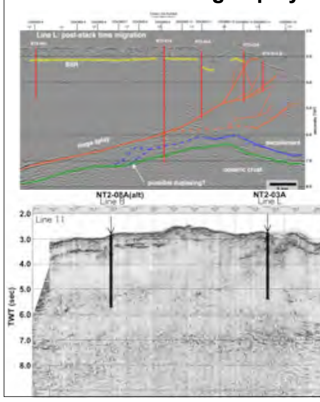
NT2-07A: **Intersecting the splay fault at 2 km bsf**

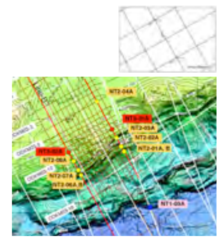




Crosslines	ODKM3-B and 14
Water Depth	2260 m
TD	675 / 845 mbsf
Coring	Full
DM	LWD/DVTP/CORK
Peff, btm	MPa
Temp, btm	degC

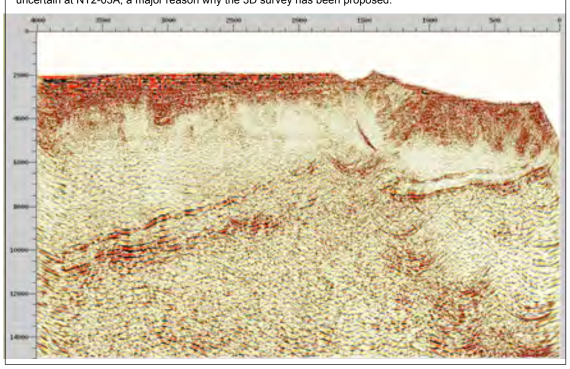
NT2-08A: **Mega-splay at ~ 3 kilometers**



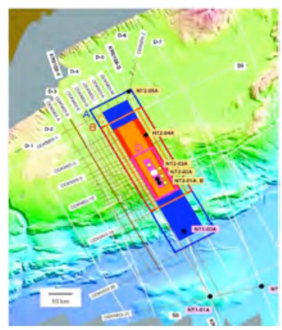


Crosslines	ODKM3-B and 11
Water Depth	2170 m
TD	2910 mbsf
Coring	Yes
DM	LWD/DVTP/Drill stem/RFT /Borehole observatory
Peff, btm	MPa
Temp, btm	degC

JAMSTEC MCS line ODKM03-L preliminary depth section. Pre-stack depth migration was conducted by CDEX, with simple velocity structure. Greg Moore (Uinv. Hawaii) and Yasuyuki Nakamura (Univ. Tokyo) are now working on their own processing and interpretation. As of this writing, locations of the splay faults are uncertain at NT2-03A, a major reason why the 3D survey has been proposed.



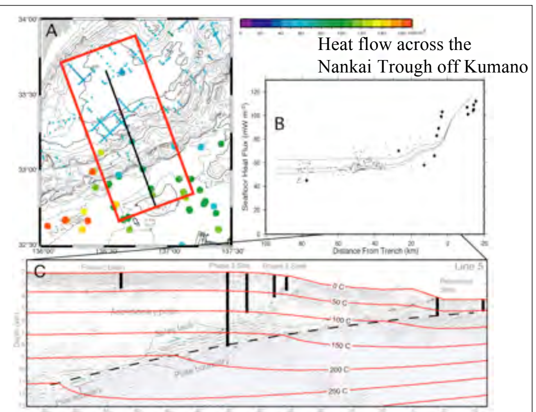
Proposed 3-D Seismic Reflection Survey



- Proposed US-Japan collaboration, funded by CDEX, MEXT (IFREE), NSF, other?
- To be acquired through a commercial contract, with modern industry methods
- Goal is to collect one survey that satisfies engineering needs and science needs
  - Engineering: 3D control on high-resolution geology, velocity structure for well design
  - Science: Splay fault and decollement architecture, seismic attributes
- U.S. Proposal is pending with NSF now (Moore, Bangs, Tobin, Saffer, and Gulick are Pis), Japanese funding also under discussion
- … perhaps early 2006?

Potential Safety Issues

- Clathrate and Hydrocarbon
- Man-made Hazards
- Kuroshio current
- Typhoon / Rough weather
- Anomolous formation pore pressure



Inferred thermal structure (Preliminary result by Kelin Wang)

Regional Clathrate and Hydrocarbon Occurrences

- Low TOC, T<100degC (NT2-03A)
  - Not probable for thermogenic gas
- Methane Hydrate – BSRs widely exist at ~400 mbsf
- MITI drilling in 1999-20

MITI Drilling

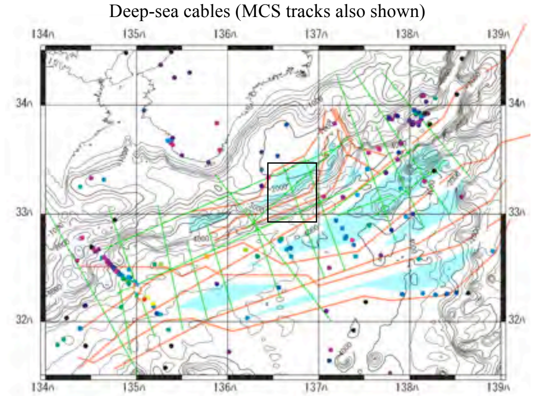
Borehole sites drilled by MITI

- Methane hydrate as a pore-filling form
- Saturation up to 80 %
- Methane hydrate-bearing turbiditic sand layers are less than 1 m thick, with a total thickness of 12.4 m

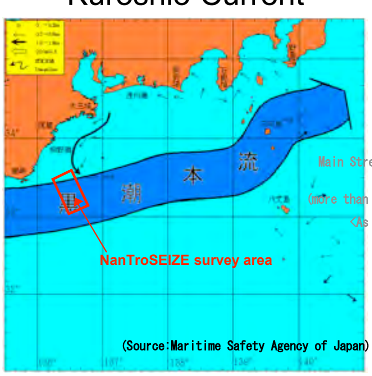
Potential Man-made Hazards

- *Dumpsites*
  - no knowledge of dumpsites in this area
- *Undersea Cables*
  - Cable positions are known, and all of the proposed sites are far enough from the cables

Deep-sea cables (MCS tracks also shown)

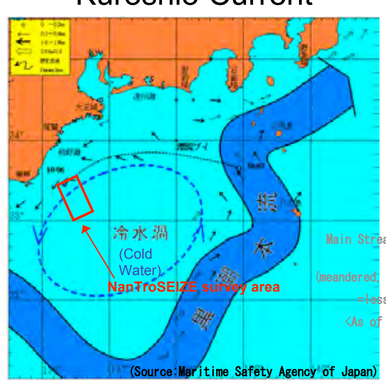


Kuroshio Current

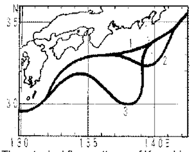


- • Presented
- at EPSP Mtg. in June,2004

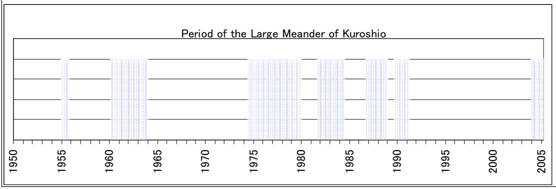
Kuroshio Current



The Kuroshio Current



Three typical flow patterns of Kuroshio.
1,2: NLM, 3: LM.

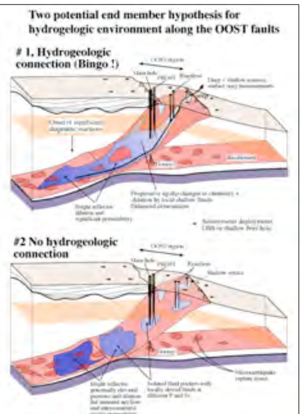


Typhoons and Low pressure front in winter

- Typhoons often occur in July through September. On average we encounter 11 typhoons per year within 300 km of Japanese coast. Pathways of typhoon changes with time, and in September it comes along the southern coast of Japan.
- In winter we encounter low pressure frontal lines, which cause strong wind and high wave. Thus the best time window for the drilling operations is April through August.

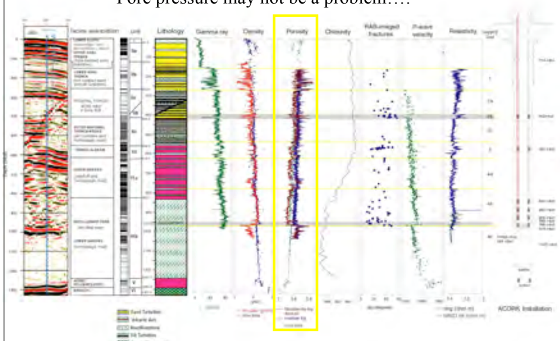
Overpressured fault zones or footwall blocks

Water, not gas, is expected.



Replace fig.

Pore pressure may not be a problem….

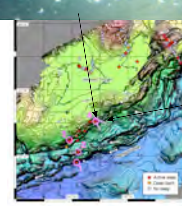


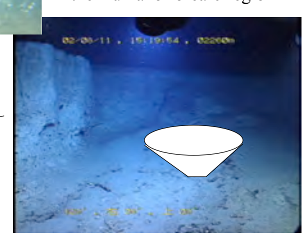
Other specific issues for EPSP

- A slope angle (~15 deg) of the seafloor at site NT2-03A
- Potential landslides caused by an earthquake
  - In September 2004, during the cruise KY04-11 using JAMSTEC R/V "KAIYO", we observed the seafloor near the epicenter of M7.4 earthquake that occurred only two weeks before. The seafloor was so turbid and the sediment was so soft, implying the occurrence of turbidity flow after the earthquake.

Numerous surveys conducted
Submersibles
Surface ships

Cliff found during KR02-10 cruise in the Kumano forearc region

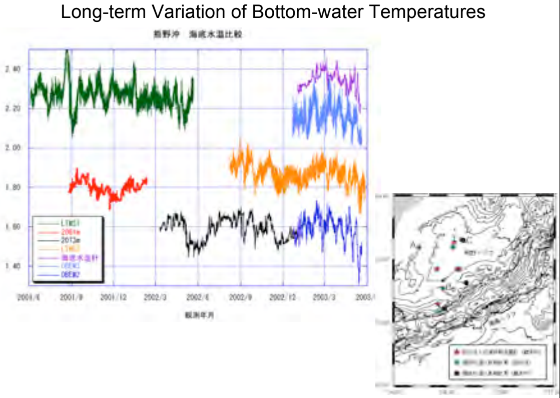




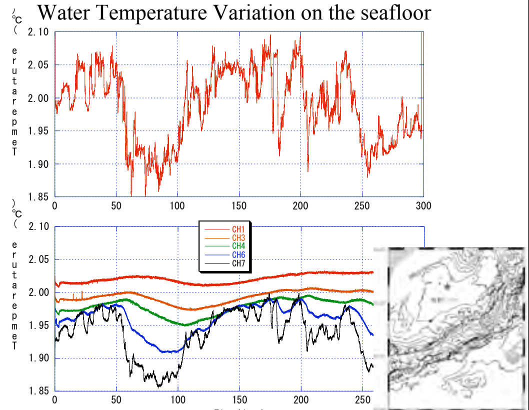
NSS Video if time allows

In order to clear these safety issues, we have to cooperate with I/O (TAMU/CDEX), with advise from EPSP.

Long-term Variation of Bottom-water Temperatures



Water Temperature Variation on the seafloor



NanTroSEIZE Phase 2 proposed sites (As of Apr 1, 2003)

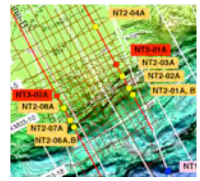
Site Name	Position	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
NT2-01A NT2-01B	33°13.6'N, 136°42.6'E	2300	1000	0	1000	Characterization of active splay fault and fluid flow regime by core sampling, logging, cross-hole experiments and long-term monitoring
NT2-02A	33°15.0'N, 136°42.0'E	2250	2000	0	2000	Study the progressive change in the fault properties by intersecting the splay fault at intermediate depth of 2km
NT2-03A	33°17.0'N, 136°41.4'E	2300	3500	0	3500	Study the progressive change in the fault properties by intersecting the splay fault at intermediate depth of 3.5km
NT2-04A	33°25.1'N, 136°37.5'E	2000	1400	300	1700	Total history of the splay fault through continuous coring the Kumano basin sediments and pilot drilling for riser platform

===PROPOSED=== *Expedition I*

Site	Description	Planned Depth	Main Operations	Estimated Days on Site
NT1-01A	Shikoku Basin basement high	460 m sediment, 50 m basement (later to 200 m)	Core, LWD, case	10.6
NT1-02A	Shikoku Basin basement plain	730 m sediment, 50 m basement (later to 200 m)	Core, LWD, case	15.4
NT2-04A	Kumano Basin tectonic history	1300m sediment	Core, LWD, case as necessary to reach TD	26.8
Total Days				52.8

===PROPOSED=== *Expedition II*

Site	Description	Planned Depth	Main Operations	Estimated Days on Site
NT2-01	Shallow mega-splay fault system	1200 m sediment	Core, LWD, case	16.5
NT3-01	Kumano basin and prism interior	~1200 m sediment (deeper riser drilling planned)	Core, LWD, case	17.6
NT1-03	Decollement at prism toe	Uppermost ~850 m or as deep as time allows	Core, LWD, case	16.7
Total Days				50.8

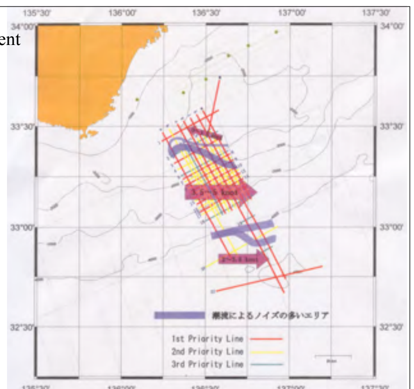


The Kuroshio Current

Can be >4 knts

Largely depends on the season

Interpretation by CDEX

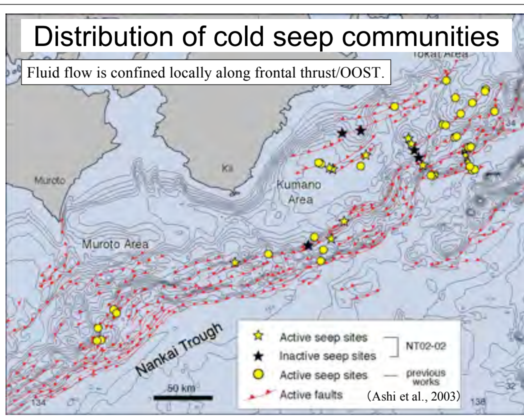


Scientific Objectives

- ***Determination of evolution, long-term slip rate and strain accumulation on mega-splay faults***
- ***Determination of systematic changes in mega-splay and wall-rock structural architecture, composition, and state with (a) increasing temperature and pressure, and (b) time.***
- ***Quantification of hydrologic properties and source of fluids along mega-splays and wall rocks***
- ***Defining the location of microseismicity and locked fault segments, and their relationship to plate boundary fault system architecture (i.e. on which faults and at what depths do events occur?)***

Distribution of cold seep communities

Fluid flow is confined locally along frontal thrust/OOST.



(Ashi et al., 2003)

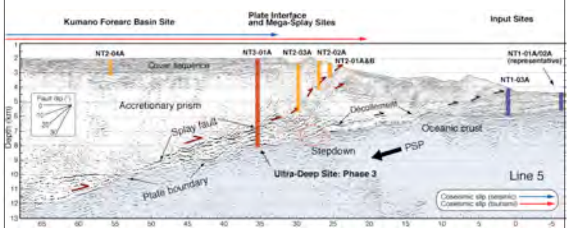
Phase 2: Drilling and observatory into the mega-splay

M. Kinoshita/K. Brown/D. Saffer/P. Henry et al.

(1) Characterize the magnitude and nature of strain accumulation and slip along mega-splays off the Kii peninsula

(2) Sample and instrument the mega-splay fault system at a range of P-T conditions from ~1-3.5 km bsf.

- intersection of the active mega-splay fault system at three depths from ~1 to ~3.5 km bsf (down dip evolutionary studies from stable to unstable slip).
- coring in the Kumano Basin (evolution of the mega-splay)
- Long-term observatory of Geodesy, seismology and hydrology
- Pilot hole for phase 3



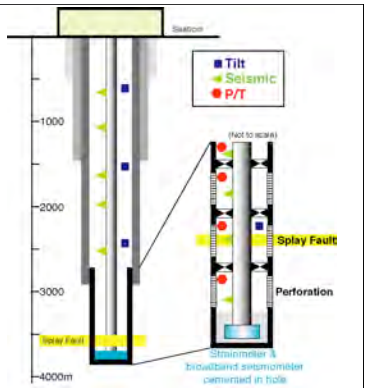
How do we test hypotheses ?

Hypothesis	Core analysis	Logging DHM	Observatory
1:MS is locked	Sedimentary sequence high-res.dating		Slip rate Strain accum.
2:MS is weak	Microstructural analysis Multi-holes	RAB DVTP-P VSP	Strain/Seism.
3:Prop. change w/P-T, become unstable	Microstructural analysis Multi-holes	RAB DVTP-P VSP	P/T
4:Hydrological connection	Permeability Fluid chem.	Porosity VSP	P/T
5:Prop. change w/time			All

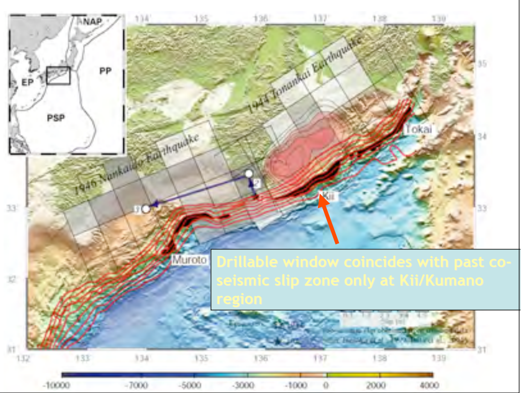
Proposed plan for the borehole long-term monitoring station

Based on:
1)discussion by the scientific community
2)conceptual design by CDEX

Now being reviewed externally for its SCIENTIFIC relevance,
Not technical feasibility.

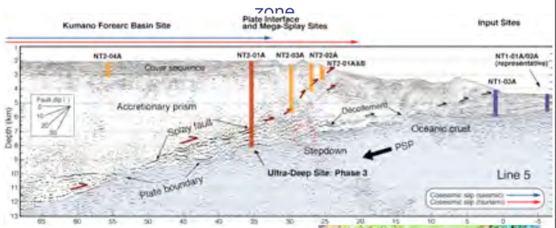


Drillable window: Water ≤ 2.5 km + Plate Interface ≤ 7000 m subbottom

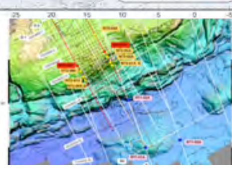


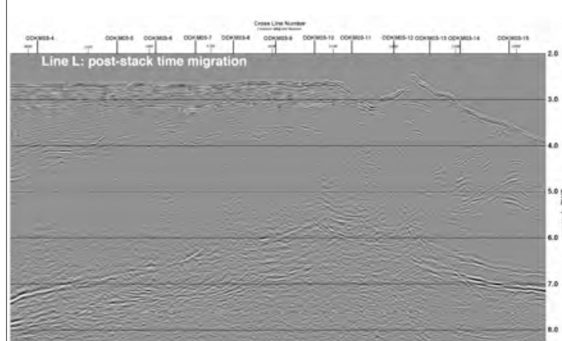
Phased Drilling Plan

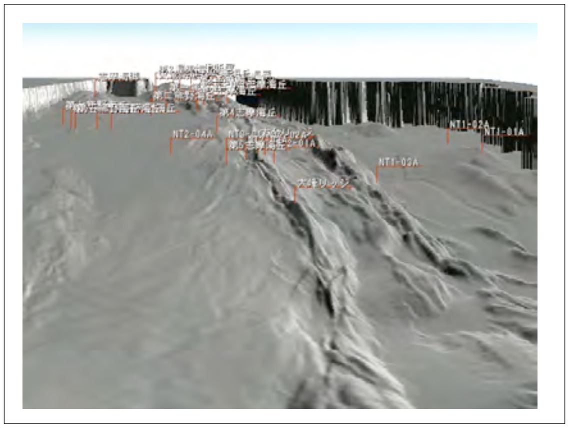
Sample and instrument at the up-dip limit of seismogenic zone



Phase 0: Geophysical/Geologic Charact
Phase 1: Incoming section and crust
Phase 2: Mega-splay fault to ~ 3500 m
Phase 3: Plate interface to ~ 6200 m






第4志摩海丘
NT2-04A
NT1-02A
NT1-01A
NT1-03A

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Appendix L

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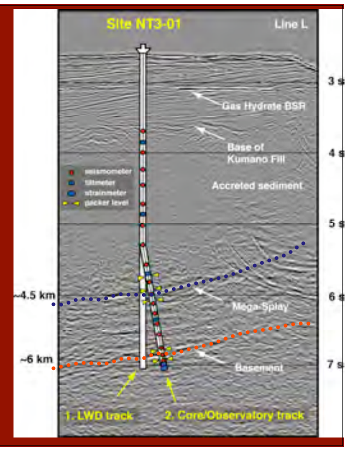
NT3-01: Deep 6k Site

Megathrust Site Observatory: Fault Zone Monitoring

- Pilot Hole coring/logging 0 - 1000 m
- Deepen Hole to ~ 6000 m TD
  - Heavy use of LWD, limited coring
  - Nested casing strings from 30” to 9 5/8”
- Sidetrack above mega-splay and core 2nd crossing of faults
- Active hydrological/stress experiments (DST, MDT)
- Completion - Install Observatory (proposed):
  - Multiple perforated, packer isolated intervals
  - Multiple sensor strings
  - Long-term fluid sampling (?)
  - Real-time data transmission via proposed sea floor cable network



NT3-01

- Water depth 1950 m
- Planned TD ~6200 mbsf (possibly ~5600 mbsf, depends on improved velocity model)
- Major targets:
  - Bottom of Kumano basin section at 1000 mbsf
  - Mega-splay fault main strand at ~4500 mbsf
  - Top of basement and presumed decollement at 5500 - 6000 mbsf
  - 200 m of basement penetration

NT3-01

- Expected geology:
  a) 0-1000 mbsf: High porosity turbidite and hemipelagite of Kumano basin (muds and sands), poorly consolidated
  b) 1000 - 3600 mbsf: consolidated accretionary prism rocks, mostly mudstone (shale) and some sandstone, faults and veins
  c) 3600 - 6000 mbsf: consolidated sedimentary rock of lower prism, probably mostly shales, possible minor basalts, cherts
  d) 6000 - 6200 mbsf: pillow basalts, basaltic/gabbroic basement, volcaniclastic sandstone.

Coring and Logging
(to be finalized; this is from proposal)

- Coring:
  - Continuous core 0 - 1500 mbsf.
  - Some intervals of coring from 1500 - 4000 mbsf, to be determined by time available
  - Continuous coring from 4000 - 6200 mbsf, *only after LWD track completed*.
- Logging:
  - LWD entire site, with best available LWD suite.
  - Wireline for special logs if possible, e.g., sonic, FMI, (sonic inside casing?)

Downhole Measurements
(during operations)

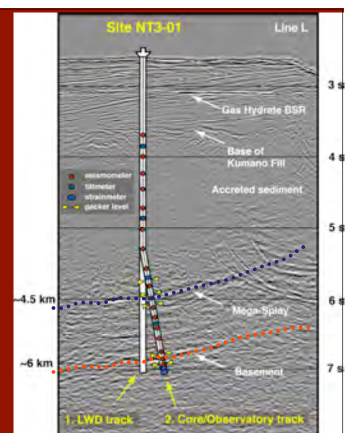
- Drill Stem Test, wireline packer tests of pore fluid pressure, permeability, hydrofrac stress at several levels
- MDT or CHDT style test for pressure, fluid sample
- DVTP-P or Piezoprobe tests in shallow seds for P, T.

Long-term monitoring

- Multi-level (up to 6) packer isolated perforated zones: basement, decollement, above decollement, beneath splay fault, splay fault, above splay fault.
- 2. Seismic array: 10 to 100 3 component short-period sensors clamped in borehole; 1 BroadBand at bottom of hole, cemented into place.
- 3. High-resolution tiltmeters at 4-5 levels spanning 2000 – 6000 mbsf.
- 4. Temperature measurements spanning fault zone intervals (3500? – 6000 mbsf)
- 5. Volumetric strainmeter cemented in outside casing at base of hole, (other levels if possible).
- 6. Fluid sampling over time (osmosamplers)?
- 7. EM conductivity/potential measurements?

Megathrust Site Observatory:
Fault Zone Monitoring

- Pilot Hole coring/logging 0 - 1000 m
- Deepen Hole to ~ 6000 m TD
  - Heavy use of LWD, limited coring
  - Nested casing strings from 30" to 9 5/8"
- Sidetrack above mega-splay and core 2nd crossing of faults
- Active hydrological/stress experiments (DST, MDT)
- Completion - Install Observatory (proposed):
  - Multiple perforated, packer isolated intervals
  - Multiple sensor strings
  - Long-term fluid sampling (?)
  - Real-time data transmission via proposed sea floor cable network



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Appendix M

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A Possible Flow of Operations

Only a rough idea, to start thinking…

Assume we begin in year 20XX.

What will we do first, second, third… etc.?

Guiding Principles

- Start with easier things, work up to bigger challenges.
- Build time into schedule between Operation Stages, to use data to adjust next stages.
- Try simple observatories first, work up to complex installations. Test technologies in simple versions.
- Build for flexibility. Assume boreholes can be used for many years, but instruments will fail.
- Identify critical decisions that will affect later operations (e.g., casing, well-head, cemented instruments). Plan these carefully.

Stage 1 - Drill and core non-riser:

- NT1-01 to TD - core, LWD
- NT1-06 to TD - core, LWD
- NT1-03 to 550 m - (same)
- NT3-01 upper ~1000 m - Kumano basin seds plus 200 m prism unit (core + LWD)
- NT2-04 (1300 m version) - core, LWD, emplace simple CORK to measure (one-level) P and deploy temperature string.

No other CORKing, case only as necessary for non-riser drilling

Stage 2: More non-riser, Some CORK-style installations

- NT2-01 A/B:
  - Drill, core and log A hole
  - case and install basic pore pressure, 1 seismometer observatory in A hole
  - Drill, wireline packer test in B hole
- NT2-02: *possible merge with NT2-03???*
  - Drill; core and log (LWD?) no observatory (?)
- NT2-03:
  - Drill, log, core upper ~1000 m (prep for riser)
- NT1-01, NT1-02:
  - Return for observatory installations

Expedition 3: Riser 3000 Site

- NT2-03:
  - Deepen to 3150 m TD, combination of some coring and some LWD, casing as we go [strainmeter(s)?]
  - Install initial “simple, retrievable” observatory
    - What is it?

Expedition 4: Riser 6000 Site

- NT3-01:
  - Deepen to ~6000 m TD with LWD, casing
  - Sidetrack to take continuous core across faults (bottom - cement strainmeter?)
  - Install removable “simple” observatory

Go Away! **Think about data. Record on seismic array. Wait. Think some more. Lay out final instrument Configuration for 2 deep observatories (3.5 km and 6 km holes)**

Expedition 5: Install Full Deep Monitoring System

- NT2-03 and NT3-01:
  - Deploy “final” monitoring system in boreholes.

Stage 6

- Record glorious data until we are all very old…

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Appendix N

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Long-term Observatory WG: Member Responsibility

- **Overall Design / Integration**
- Sensor configuration plan, including seafloor network (S)
- Specifications for each sensor (S)
- Integration of hydrological and geodetic/seismological observatories (IO)
- Engineering development as IODP-SOC (IMI)
- Behind-casing technique (IMI)
- Casing vs. clamping (S/IO)
- Prioritization (IMI)
- Implementation Plan (Platform, schedule, etc.) (IO)

Long-term Observatory WG : Member Responsibility

- **Hydrological observatory**
- CORK or substitute (IO)
- Packer (IO)
- Pressure measurement (tubing, P gauge, data logger) (S)
- Temperature measurement (sensor, data logger) (S)
- Fluid Sampling (S/IO)
- EM sensors (S)
- Data acquisition and maintenance (S)

Long-term Observatory WG : Member Responsibility

- **Geodetic observatory**
- Estimation of overpressure status (S)
- Wellhead and conductor/hydraulic feed-through (IO)
- Casing and perforation (IO)
- Cementing (IO)
- Telemetry (IO)
- Strainmeter development (S)
- Tiltmeter development (S)
- Data acquisition and maintenance (S)

Long-term Observatory WG : Member Responsibility

- **Seismological observatory**
- Wellhead and conductor/hydraulic feed-through (IO)
- Clamping (IO)
- Power consumption
- Number of sensors, arrangement
- **Geochemical observatory**
- **EM observatory**

PSG Request for prioritization of the borehole observatory engineering development
NanTroSEIZE Long-term observatory WG

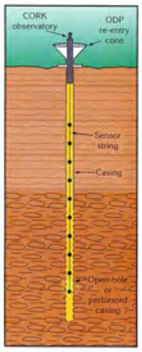
- We understand that the infrastructure of the drilled hole, including casing or wellhead, will be taken care of by the POC money of IODP. However, engineering development must be investigated as SOC. Therefore, we ask IODP-MI and SAS (EDP) to consider long-term monitoring systems and borehole system integration as a high priority for SOC engineering development.

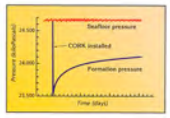
Options for infrastructure

- CORK/ACORK / ODP Geodetic holes (Phase 1)
- CDEX plan (Phase 2, not enough though)
- One observatory with composite holes (Phase 3)
- Major engineering development of the wellhead, allowing for sensor installation at many intervals
- Simple design assuming no downhole overpressure (accurate pressure estimate req.)

CORK

This is an extension of current technology achieved by ODP. Basically we intend to apply this installation for a hydrogeological observatory, but potentially geodetic sensors may be added. This is to be installed at reference sites and NT02-01A. This is the simplest and easiest solution for NanTroSEIZE shallow sites (<1009m).

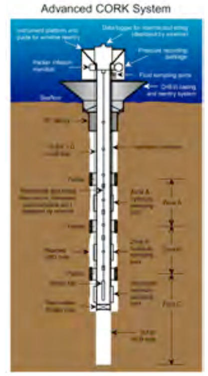




成果
　掘削擾乱からの回復過程から透水率推定
　潮汐応答から透水率推定
　地震に伴う歪の観測

CORK= Circulation Obviation Retrofit Kit

Advanced CORK System



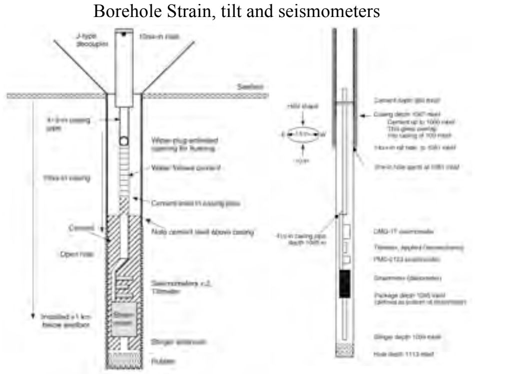
A-CORK

マルチパッカ-:断層など特定の区間の状態を知ることができる
Behind Casing Sensor:ケーシングの中に別のセンサーを設置可
観測項目:圧力・採水

ケーシングを押し込むのが困難
パッカ-の位置を特定する必要
回収・保守が不可能

IODP-ISP 2003-2013

Borehole Strain, tilt and seismometers



Sacks, I.S., Suyehiro, K., Acton, G.D., et al., 2000
Proceedings of the Ocean Drilling Program, Initial Reports Volume

Options for infrastructure

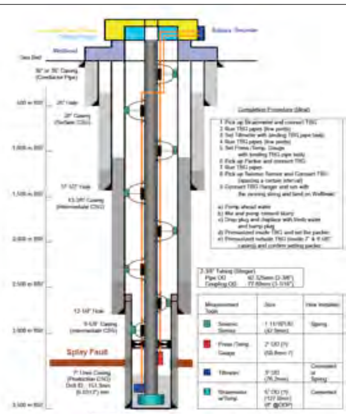
- CORK/ACORK / ODP Geodetic holes (Phase 1)
- CDEX plan (Phase 2, not enough though)
- One observatory with composite holes (Phase 3)
- Major engineering development of the wellhead, allowing for sensor installation at many intervals
- Simple design assuming no downhole overpressure (accurate pressure estimate req.)

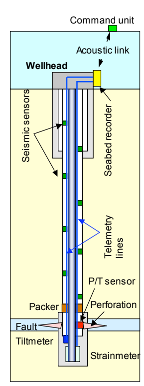
CDEX Plan
For Phase 2
Observatory

Hydrogeology+
Seismology+
Geodesy
At 0-3.5 kmbsf

Technical challenges
*Cementing
*Telemetry

→ Needs practice!



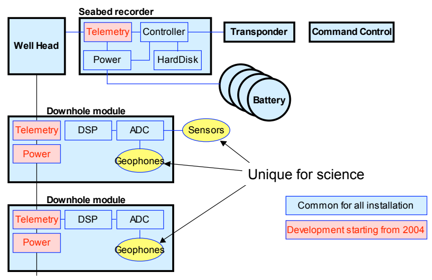


Phase II Installation Plan

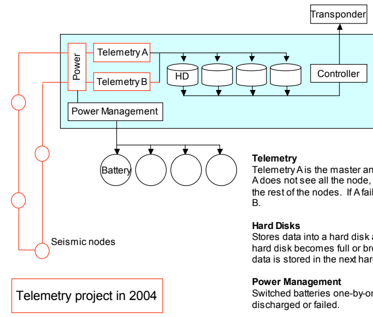
Data rate & power consumption

Data volume and power	Seismic	Tiltmeter	Strainmeter	P/T	Total
Word length [bits]	24	24	24	24	
Power per level [W]	2	0.45	0.1	0.54	
Number of levels	8	1	1	1	
Components per level	3	2	1	2	
Sampling [samples/s]	250	10	10	10	
Data rate [kbps]	144	0.48	0.24	0.48	145
Data per year [Gbytes]	567.648	15.13728	7.56864	15.13728	605
No. of 240GB HD	2.3652	0.063072	0.031536	0.063072	3
Downhole power [W]	16	0.45	0.1	0.54	17

Typical Monitoring System



Redundant Telemetry



Telemetry
Telemetry A is the master and B is a backup. If A does not see all the node, B tries to access the rest of the nodes. If A fails, B will take over B.

Hard Disks
Stores data into a hard disk at a time. If the hard disk becomes full or broken, then the data is stored in the next hard disk.

Power Management
Switched batteries one-by-one as a battery is discharged or failed.

Options for infrastructure

- CORK/ACORK / ODP Geodetic holes (Phase 1)
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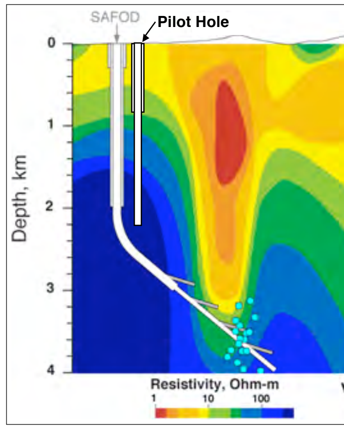
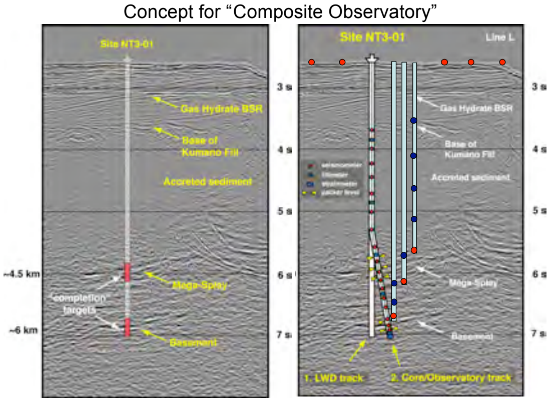
- Simple design assuming no downhole overpressure (accurate pressure estimate req.)



SAFOD Pilot Hole Goals

- ✓ Provide technical information about drilling conditions prior to SAFOD.
- ✓ Measure stress, fluid pressure and heat flow adjacent to the fault zone.
- ✓ Record surface sources during seismic experiments in October 2002/2003.
- ✓ Facilitate precise location of target earthquakes for SAFOD.
- ✓ Test seismic, pressure, and strain monitoring instruments for SAFOD.
- ✓ "Calibrate" physical properties from surface geophysical surveys.
- ✓ Reveal nature and extent of fluid/rock interaction

Concept for "Composite Observatory"



Options for infrastructure

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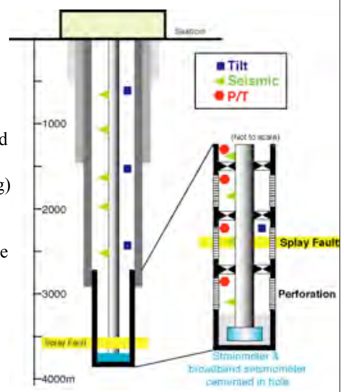
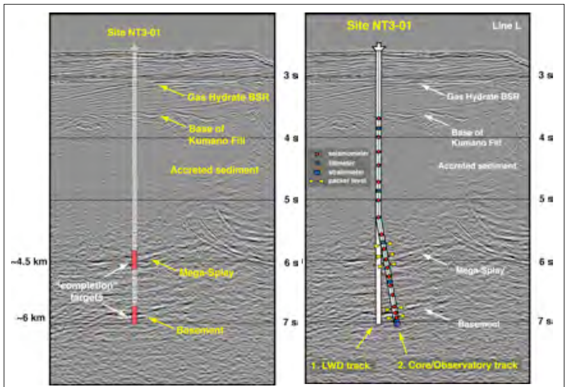
Proposed plan for the borehole long-term monitoring station

Challenges

*Geodetic sensors cemented at multi-levels (wellhead/cementing/casing)

*Hyd/Seis/Geo in the same hole (separate hole desirable if available)





Options for infrastructure

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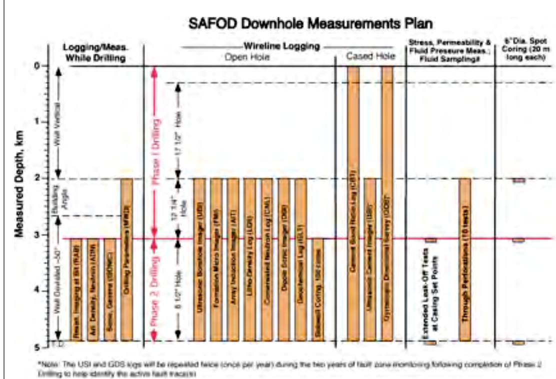


How do we test hypotheses ?

Hypothesis	Core analysis	Logging DHM	Observatory
1:MS is locked	Sedimentary sequence high-res.dating		Slip rate Strain accum.
2:MS is weak	Microstructural analysis Multi-holes	RAB DVTP-P VSP	Strain/Seism.
3:Prop. change w/P-T, stable/unstable transition	Microstructural analysis Multi-holes	RAB DVTP-P VSP	P/T
4:Hydrological connection	Permeability Fluid chem.	Porosity VSP	P/T
5:Prop. change w/time			All

What we know by now

- Seismic (MCS+OBS) Surveys, including 3D survey in early 2006
  - 3D structure of OOST
  - Polarity diversity along OOST
  - Muroto 3D results, effect of subducting basement topography / amplitude? (Park)
- Micro Seismicity
  - Low seismicity
  - Low /very low freq. seismicity
- Crustal movement
  - Slow slip
- EM structure
  - Conductive near the updip plate boundary
- Thermal structure

What we know by now (continued)

- Detailed bathymetry and backscatter imagery (Wadatsumi)
  - Landslides?
  - Not enough resolution for fault scarp and seep community mapping? – need AUV
- Dives
- Pinpoint corings (NSS)
- Seafloor Observatory

So, what shall we do NOW.

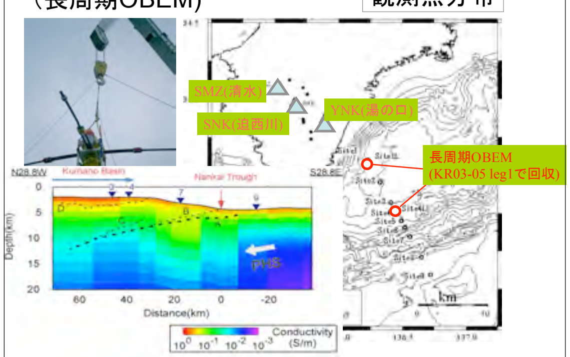
- Site characterization
  - 3D seismic
  - Dives
  - Deeptow sidescan and SBP
  - Seafloor observatory
- Laboratory and Numerical Experiments
  - Regional stress/strain/T/P
  - Rupture nucleation/propagation process
- Development of observatory tools
- New proposals, not as NanTroSEIZE?
  - Engineering expedition (MBARI type)
  - Seismogenic Drilling at Sumatra?

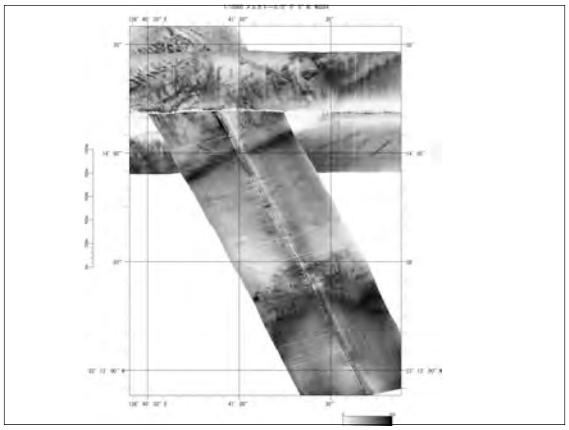
Activity / Schedule

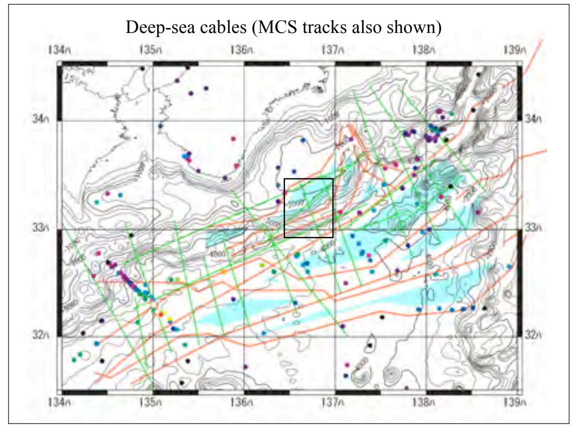
Heisei	16	17	18	19	20	21
Calemder Y	2004	2005	2006	2007	2008	2009-
Seismic Survey	2D	wideangle	3D	wideangle relect/refract		
Other Survey	Dives/NSS/ Wadatsumi	NSS	SONNE			
IODP Expeditions				???????		
Observatory	CORK@CR ACORK@Nankai	Sealfoor benchmark Sagami Bay				
Proposal status PSG	603CDP,A,B ranked 1	603C ranked 2				
Proposal						
Synthesis						
Other						

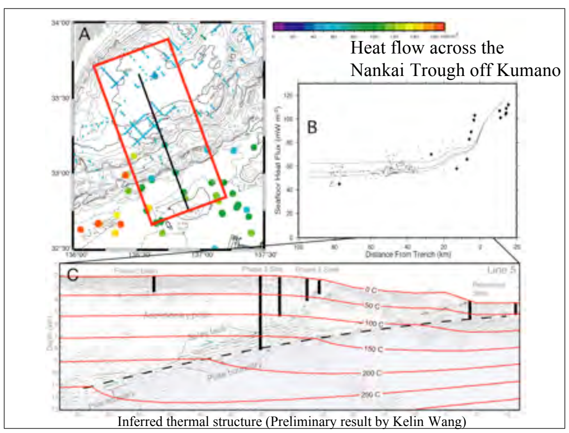
海底電位差磁力計
（長周期OBEM)

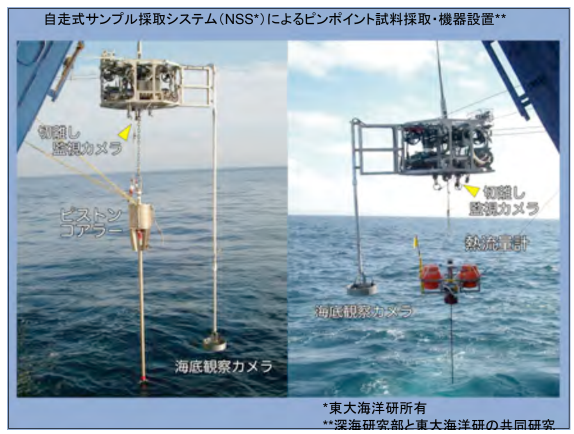
観測点分布

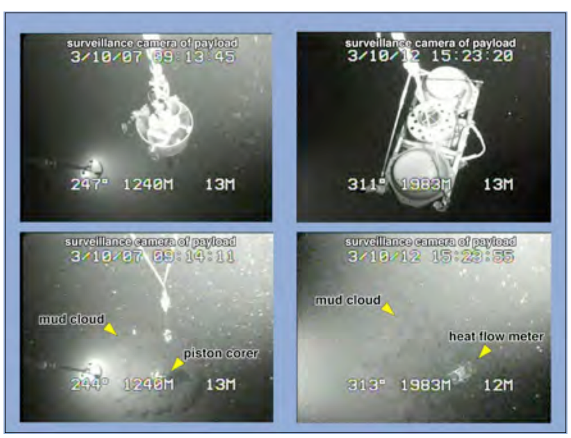


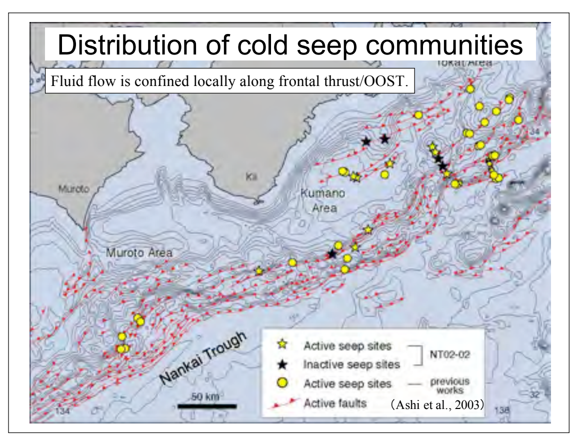


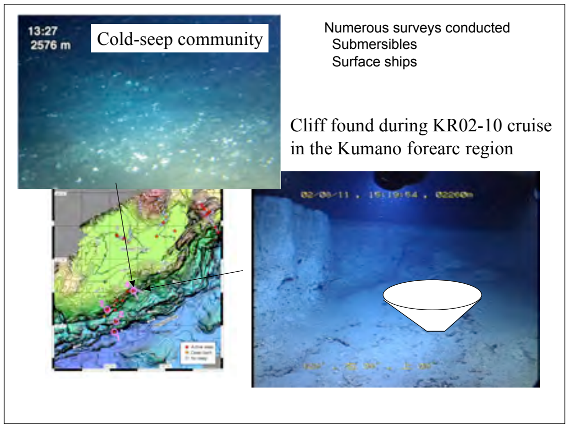

Deep-sea cables (MCS tracks also shown)

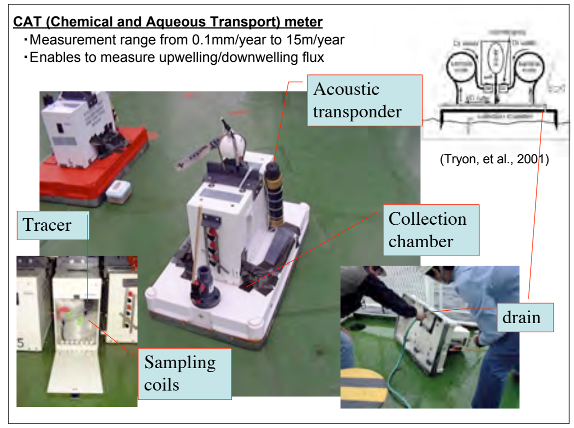

Heat flow across the
Nankai Trough off Kumano
A
B
C
Inferred thermal structure (Preliminary result by Kelin Wang)

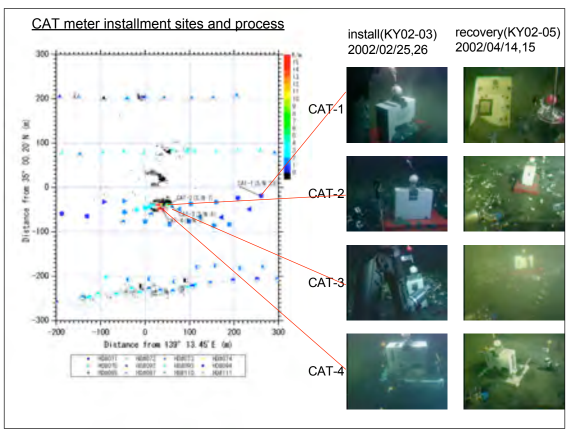

自走式サンプル採取システム（NSS*）によるピンポイント試料採取・機器設置**
切離し
監視カメラ
ピストン
コアラー
海底観察カメラ
切離し
監視カメラ
熱流量計
海底観察カメラ
*東大海洋研所有
**深海研究部と東大海洋研の共同研究


surveillance camera of payload
3/10/07 09:13:45
247° 1240M 13M
surveillance camera of payload
3/10/12 15:23:20
311° 1983M 13M
surveillance camera of payload
3/10/07 09:14:11
mud cloud
piston corer
244° 1240M 13M
surveillance camera of payload
3/10/12 15:23:55
mud cloud
heat flow meter
313° 1983M 12M


Distribution of cold seep communities
Fluid flow is confined locally along frontal thrust/OOST.
Tokai Area
Kii
Muroto
Kumano
Area
Muroto Area
Nankai Trough
50 km
Active seep sites
Inactive seep sites
NT02-02
Active seep sites
previous works
Active faults
(Ashi et al., 2003)


13:27
2576 m
Cold-seep community
Numerous surveys conducted
Submersibles
Surface ships
Cliff found during KR02-10 cruise
in the Kumano forearc region


CAT (Chemical and Aqueous Transport) meter
・Measurement range from 0.1mm/year to 15m/year
・Enables to measure upwelling/downwelling flux
Acoustic
transponder
(Tryon, et al., 2001)
Tracer
Collection
chamber
drain
Sampling
coils


CAT meter installment sites and process
install(KY02-03)
2002/02/25,26
recovery(KY02-05)
2002/04/14,15
CAT-1
CAT-2
CAT-3
CAT-4
Distance from 139° 13.45' E (m)

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Report of the NanTroSEIZE PSG

Sante Fe, New Mexico February 24-25, 2005

Appendix O

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Proposed Monitoring Working Group

GOAL: Develop a dedicated working group to develop the long-term monitoring plan for the NanTroSEIZE project.

Possible Members:

Seismology:

Ralph Stephen	rstephen@whoi.edu	Woods Hole OI
?Koichiro Obana	obanak@jamstec.go.jp	IFREE/JAMSTEC
Kiyoshi Suyehiro*	suyehiro@jamstec.go.jp	JAMSTEC
Peter Malin	malin@duke.edu	Duke University
Hisao Ito	hisao.itou@aist.go.jp	AIST
!Ryota Hino	hino@aob.geophys.tohoku.ac.jp	Tohoku Univ.
? Bill Ellsworth		USGS

Hydrogeology:

Liz Screaton	screaton@ufl.edu	Un. of Florida
Demian Saffer	dsaffer@geosc.psu.edu	Penn State U.
Kevin Brown*	kmbrown@ucsd.edu	Scripps IO
Earl Davis	edavis@nrcan.gc.ca	Pac Geoscience Ctr, Canada
Keir Becker	kbecker@rsmas.miami.edu	U. Miami
!Tomochika Tokunaga	tokunaga@geosys.t.u-tokyo.ac.jp	Univ. Tokyo
!Masa Kinoshita		

Geodetic (Strain, Tilt):

Eiichi Araki	araki@jamstec.go.jp	JAMSTEC
Selwyn Sacks	sacks@dtm.ciw.edu	Carnegie Institute
Masanao Shinohara	mshino@eri.u-tokyo.ac.jp	ERI U. Tokyo
Mark Zumberge??	mzumberge@ucsd.edu	Scripps IO

Geochemistry:

Tomohiro Toki	toki@ori.u-tokyo.ac.jp	ORI U. Tokyo
Geoff Wheat	wheat@mbari.org	MBARI
Miriam Kastner	mkastner@ucsd.edu	Scripps IO

Microbiology:

Not sure yet who…

!EM

!Pierre Henry		
!Tadanori Goto	tgoto@jamstec.go.jp	IFREE/JAMSTEC
!US?		

Borehole and Sensor Engineering: needs to break down more?

Jun Tomomoto	tomomoto@jamstec.go.jp	CDEX
Tom Pettigrew	tom.pettigrew@stress.com	Mohr Engineering
Randy Normann	ranorma@sandia.gov	Sandia National Lab
[USIO rep]		
![J-DESC rep]		

Integration:

Harold Tobin	tobin@nmt.edu	New Mexico Tech
Masa Kinoshita	masa@jamstec.go.jp	DSR/JAMSTEC
Shinichi Kuramoto	s.kuramoto@jamstec.go.jp	CDEX

* also geodetic interest

Report of the NanTroSEIZE PSG

Sante Fe, New Mexico February 24-25, 2005

Appendix P

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General Considerations for NanTroSEIZE PSG

Santa Fe meeting Dec 2004

Randy Normann
PI High-Temperature Electronics
Geothermal Research Dept.
Sandia National Labs

Past Sandia and NEDO Relationship

Dr. Seiji Saito, Tohoku University, Dept. of Geoscience & Technology

- Very respected geothermal researcher
- Sandia supplied HT tools to support Dr. Seiji Saito projects
- Dr. Seiji Saito wrote reports on using Sandia tools in Japanese drilling projects

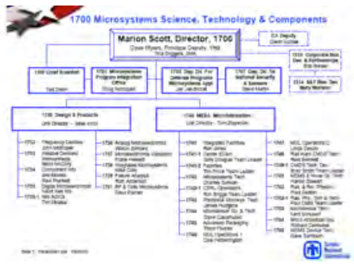
A Team Approach

- The operating life and the scientific needs required by deep fault monitoring require a team approach.
  - Short of placing a rock on the end of a string, well instrumentation requires a host of materials for creating pressure housings, lubricants, seals, fiber optic and/or electrical interconnects, sensors, printed wiring boards, cables, surface equipment, etc.

Suggested SAFOD Team

- Sandia National Labs
  - We are continuously well testing electronics and fiber optic sensors
  - The Geothermal Research Group has an ongoing 192.5C well monitoring project in Coso, Ca
- University of Maryland's CALCE center is the world's foremost authority on the physics-of-failure assessment. Currently using PoF methods for well logging tools for Schlumberger and Halliburton.

Sandia has Reliability Responsibility to the DOE and DOD



Sandia has over 200 reliability engineers and scientists

Basic HT Electronic Technology

- Commercial Industrial Grade (-20 to 85ºC) electronic components
  - Have NO operating life requirements at 85ºC
  - Have a nominal operating life of 18 months @ 150ºC*
    - PoF is electromigration with 5 mA/um2 current density
  - Outgas Bromide at ~175ºC causing random failures in 2000hrs
- HT SOI (silicon-on-insulator) from Honeywell designs 1% failure over 20 years at 150ºC (10.6 yrs at 200C).
  - PoF is electromigration with 0.5 mA/um2 current density*
  - Unfortunately, there is only a limited number of devices currently on the market.
  - Currently developing new SOI components within the Honeywell JIP.

*Reliable Electronics for High-Temperature Downhole Applications
B.L. Gingerich, SPE etal, 1999, SPE 65438

Honeywell JIP

- All of the major service companies are co-funding SOI component development
  - $8 Mil USD
- The components are needed for long-term well monitoring instrumentation
  - Improved accuracy and circuit design flexibility
- The components currently belong to the JIP members until 2007

  Suggestion: Work with one of the JIP members to gain access

Fiber Optic Reliability

- Free hydrogen in the well has been shown to greatly reduce the operating life of fiber at temperatures of 180C
- Manufacturers have responded with new fiber doping to reduce hydrogen effects
  - These new fiber have not been fully well tested
- Sandia is currently considering new fiber well testing at temperatures 225-320C starting in late 2005

Fiber Optic Sensors

- DTS– Roman Backscatter great for continuously monitoring the complete well temperature profile
  - Poor resolution
  - Multi-mode fiber has limited range, a few km
- BFG– great for pipe strain
  - BFG must be mechanically isolated from each other
  - Untested for long-term drift effects in HT wells
  - Long range 10's of km
- Fabry-Perot Interferometer – Pipe strain, temperature, pressure
  - Surface equipment complex, limited number of sensors
  - Bandwidth issues
  - Untested for long-term effects in HT wells

Current Industry Practices

- Closest commercial example: 150ºC Smart Well instrumentation
  - Normally specified at 150ºC-5yrs*
  - Relatively simple systems monitoring pressure, temperature, flow with the ability to control a production valve.
  - Complete systems are built metal pressure housings WITHOUT rubber seals.
  - Schlumberger's Bernard Parmentier's 2003 HITEN report, "No use of organic material when long-term reliability is mandatory"*

*Design of High-Temperature Electronics for Well Logging Applications
Bernard Parmentier, Schlumberger, etal, 2003 Proceeding of the International Conference on High Temperature Electronics

Current Industry Practices, Continued

- Service companies invest millions of dollars in testing materials and components for operating temperatures and life times
  - Service companies freeze circuit design required for years of testing and production
- DTS Fibers require secondary calibration
  - Loop (twice the fiber)
  - Electronic temperature measurement
- Testing done in the lab is good <u>but it doesn't really count until it is proven in the well</u>.

Sandia has access to HT wells

- We are currently testing fibers and electronics in geothermal wells
  - Coso 193C long-term test complete with satellite data transmission
  - Navy well 58A-10D, just conducted 256C. 18 hr well log without any heat-shielding
  - Utah 220C well long-term test

Coso Deployed System

Funded by the Department of Energy's National Energy Technology Laboratory (NETL)

To date, three downhole reservoir monitoring tools have been successfully deployed.

Know What You Placing in the Well

- You must allow time for lab and well testing.
  - 1 year well testing at elevated temperatures >180C
  - Provide time to make design changes following the 1 year test
- You must not place anything in the well without knowing:
  - First and second modes of failure
  - Interaction of systems to single point failures
  - Degradation caused by hydrogen
  - Degradation caused by other potential wellbore chemicals
  - Out gassing interaction of system components

Evaluation Criteria for Components

- Historical Data
  - Past applications
  - Reliability testing data
  - First & second modes of failure (PoF)
- Complete list of materials
- Assembly apprentices and QA steps
- Most evaluations will result in:
  - Suggestions for additional lab testing
  - Suggestions for production materials or assembly methods

Use Both Fiber and Electronic Sensors

- Use both fiber and electronic measurements
  - Different failure modes
  - Different advantages/disadvantages
    - Fiber—
      - Distributed sensors
      - Normally less accuracy
      - Less downhole
    - Electronics---
      - Wide range of sensor types
      - Normally single point measurement
      - Lower power
      - Greater downhole complexity

The Future

- Oil wells are getting deeper and hotter
  - Drilling companies are looking for 225C tools for Golf of Mexico drilling
- The Honeywell Joint Industry Partnership is creating NEW HT SOI components for commercial release in 2007
- The military is developing 350C SiC electronics and sensors
- Sandia is starting a 300C seismic sensor project in 2006 for long-term geothermal well monitoring

USAF, NASA Glenn and Sandia

We are currently evaluating the 600C pressure sensor for long-term stability at 250-300C. We may also adapt the accelerometers for use as a seismic sensor

I have materials on well instrumentation. Please ask me for them if interested.

Thank you,
Randy