IODP: Decadal, international science drilling programs

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Background Context

- IODP = Integrated Ocean Drilling Program, 2003-2013 program led by NSF, Japan, Europe
- IODP = International Ocean Discovery Program, new program for 2014 and beyond

We don't actually believe this, but it is nice to get positive attention!

DSDP/ODP/IODP, the Greatest Science Program in History

About.com Geology

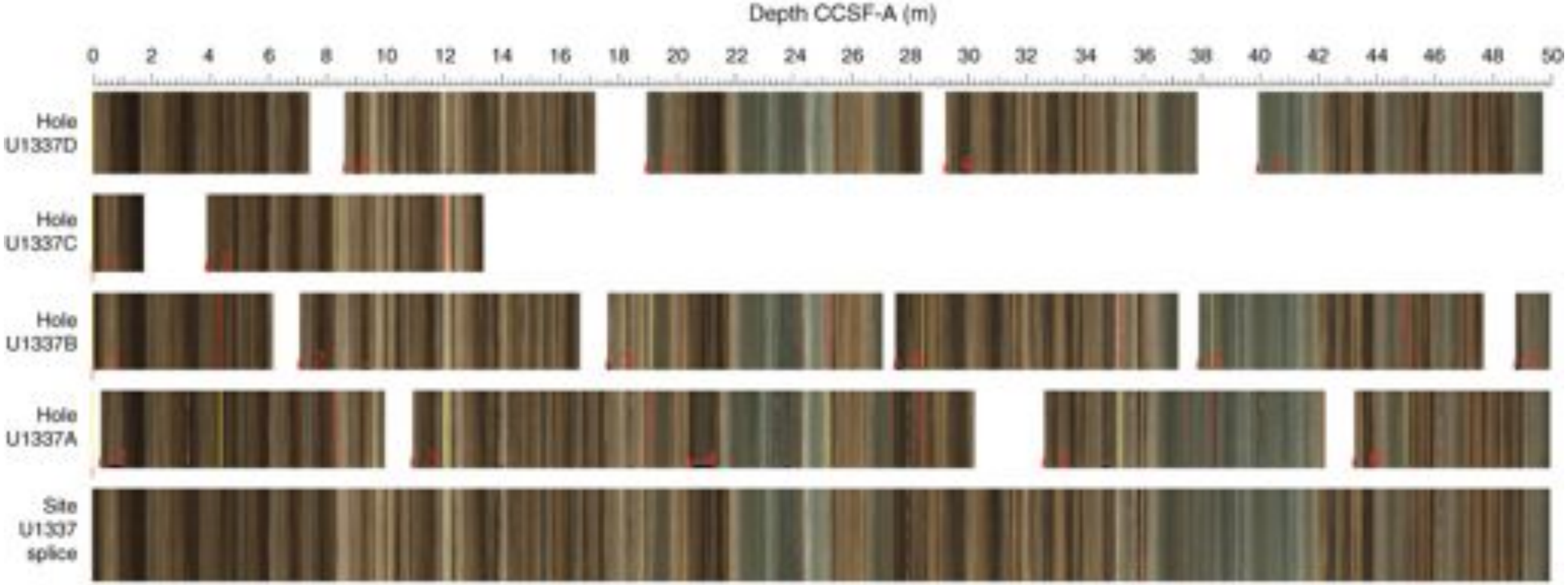
The Greatest Science Program in History

By Andrew Alden, About.com

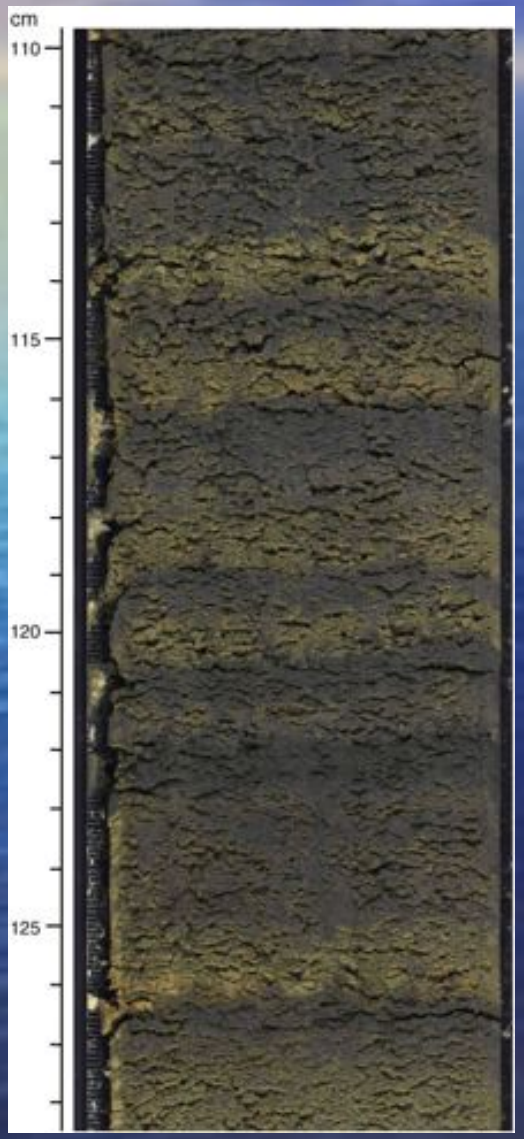
Climate History at the Equator

Scientific ocean drilling recovers sediments that are a record of Earth history (3.5Ma shown here)

IODP can obtain climate records to >440 mbsf from piston coring



Wilkes Land: Antarctic Climate



- Cored sediments over last 53 million years, that showed change from "hothouse" where crocodiles live in Antarctica, to the current "Icehouse" conditions, with Antarctica glaciation beginning 34 million years ago
- Cored annual record for last 12,000 years, since last Ice Age

BREVIA

Science
AAAS

Extending the Sub–Sea-Floor Biosphere

Erwan G. Roussel,[1] Marie-Anne Cambon Bonavita,[1] Joël Querellou,[1] Barry A. Cragg,[2] Gordon Webster,[2] Daniel Prieur,[1] R. John Parkes[2]*

The sub sea-floor contains two thirds of Earth's total prokaryotic (I.e., Archaea and Bacteria) biomass

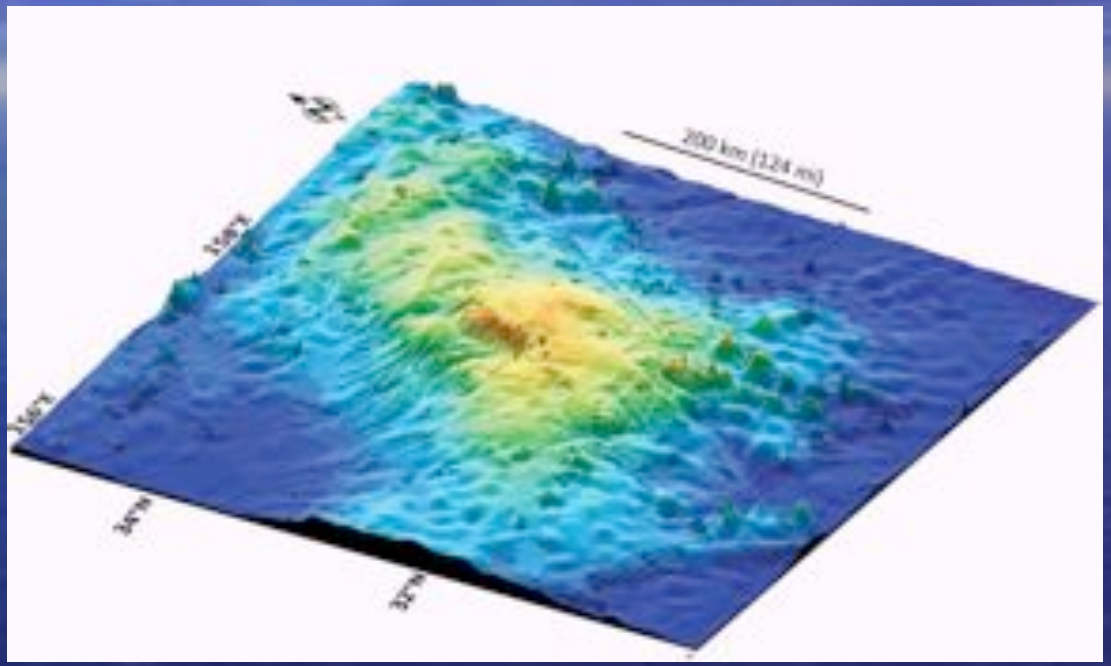
Living prokaryotes in sediments at depths greater than a kilometer, as old as 111 My, and at 60° to 100°C

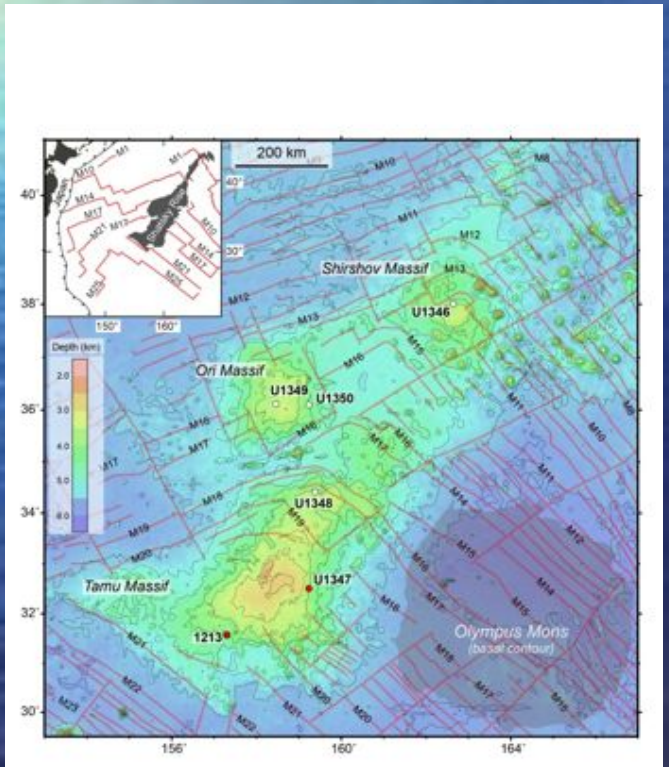
Microbe from deep beneath the Arctic seafloor (IODP leg 302).

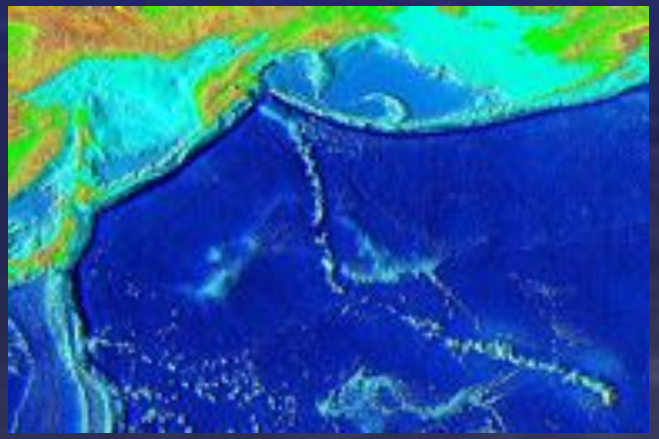
Photo courtesy of D.C. Smith.

Earth's Largest Volcano

TAMU Massif,
Western Pacific

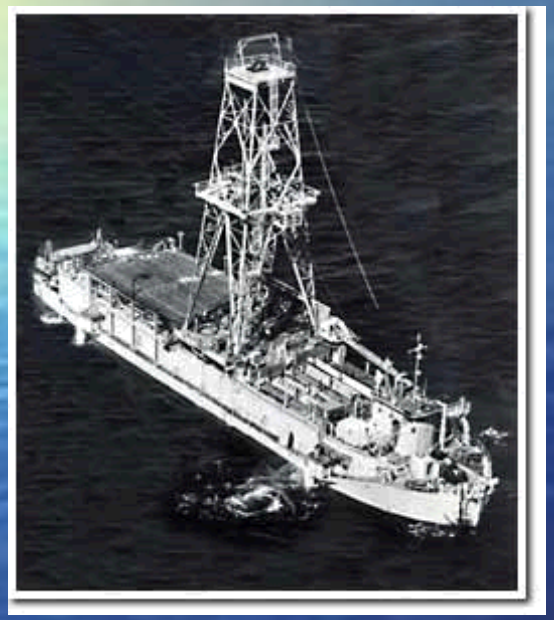






Scientific Drilling 1961-2003

One facility- simple program design

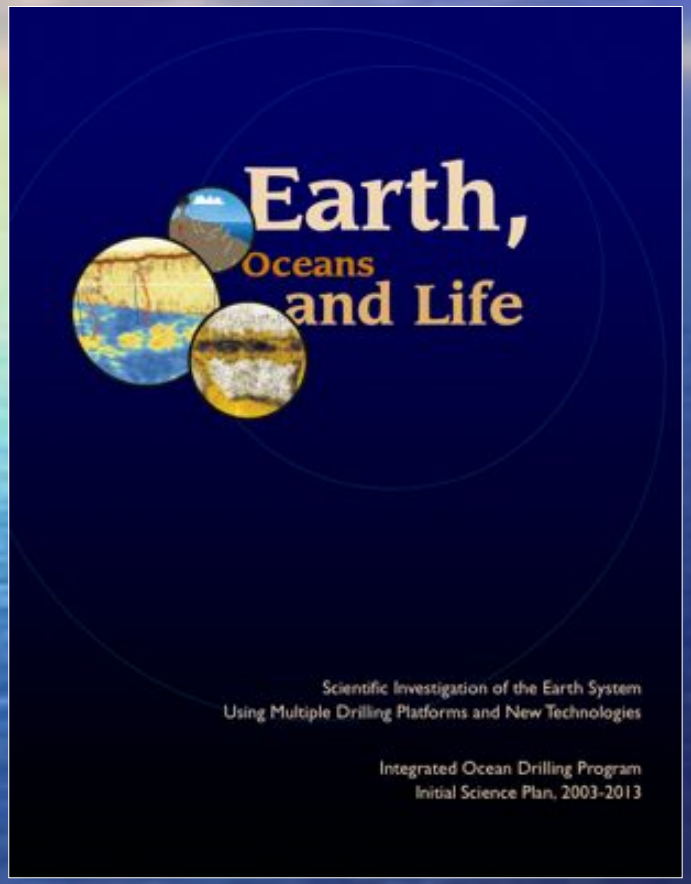


Project Mohole 1961 (Walter Munk's living room)

Deep Sea Drilling Project 1968 - 1983

Ocean Drilling Program 1985 - 2003

IODP: Ambitious Science Plan



- Scientific Themes:

✓ The Deep Biosphere and the Subseafloor Ocean;

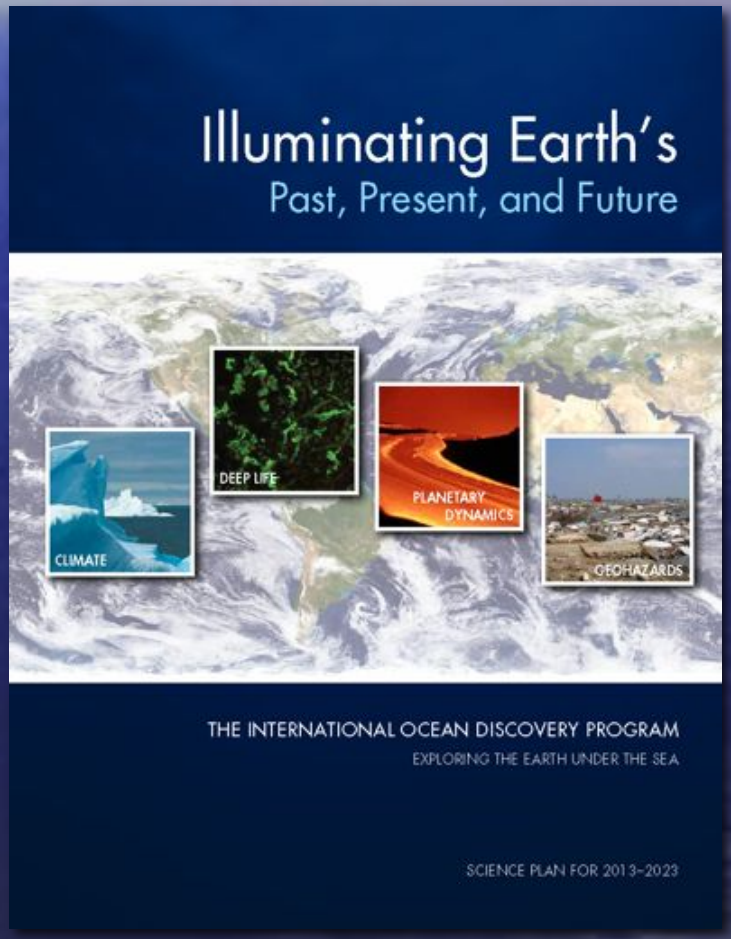
✓ Environmental Change, Processes, and Effects;

✓ Solid Earth Cycles and Geodynamics

www.iodp.org/isp

"New" IODP Science Plan

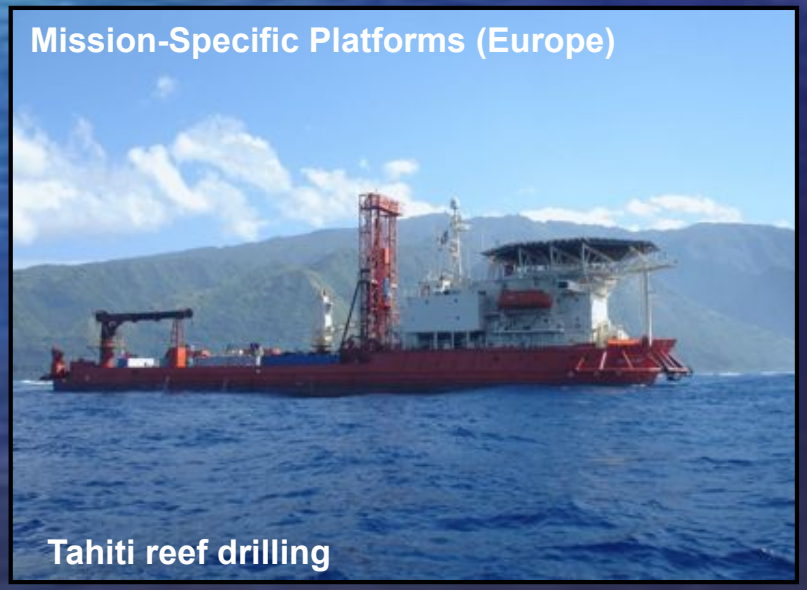
- Four Themes:
  - Reconstructing Past Climates
  - Life beneath the seafloor
  - Earthquakes and volcanoes below the oceans
  - History of Earth and its oceans




JOIDES Resolution (USA)


Chikyu (Japan)

IODP: International Partnerships as the basis for a complex multi-platform program


Mission-Specific Platforms (Europe)

Tahiti reef drilling

26+ Member nations!

The *JOIDES Resolution* is the U.S. contribution to IODP

- Converted former industry vessel (1984-1985; 2007-2009), leased from Siem Offshore
- 471 ft long, 70 ft beam, 10,282 ST, 202 ft derrick, 9000hp, Ice Class 1B
- 30,000 ft drillstring; water depths >7000m
- Total operational cost of about $175,000/ day
- Uses MGO fuel; avg 35t/day transit; 25t/ day while drilling

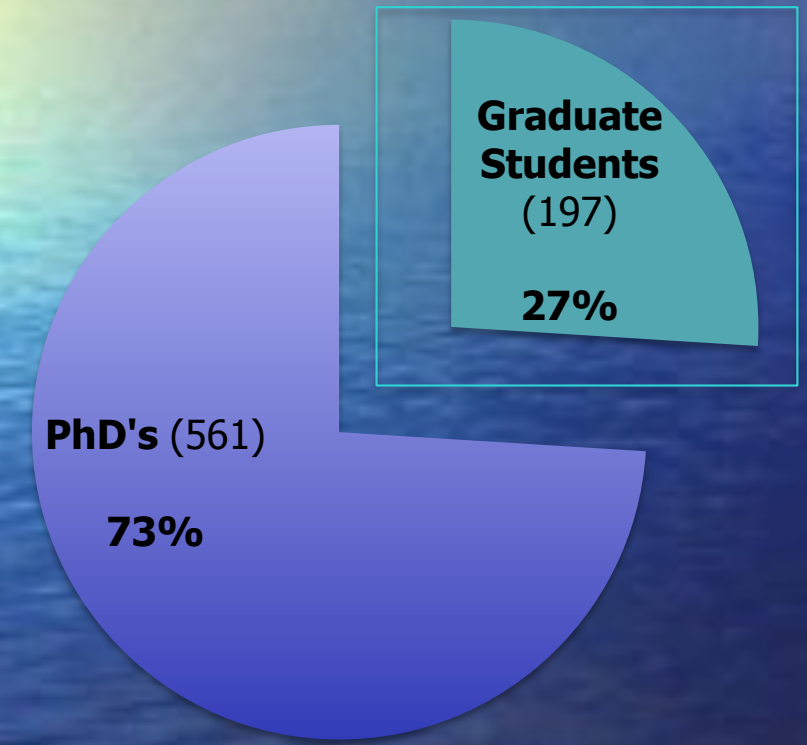
More *JOIDES Resolution* facts

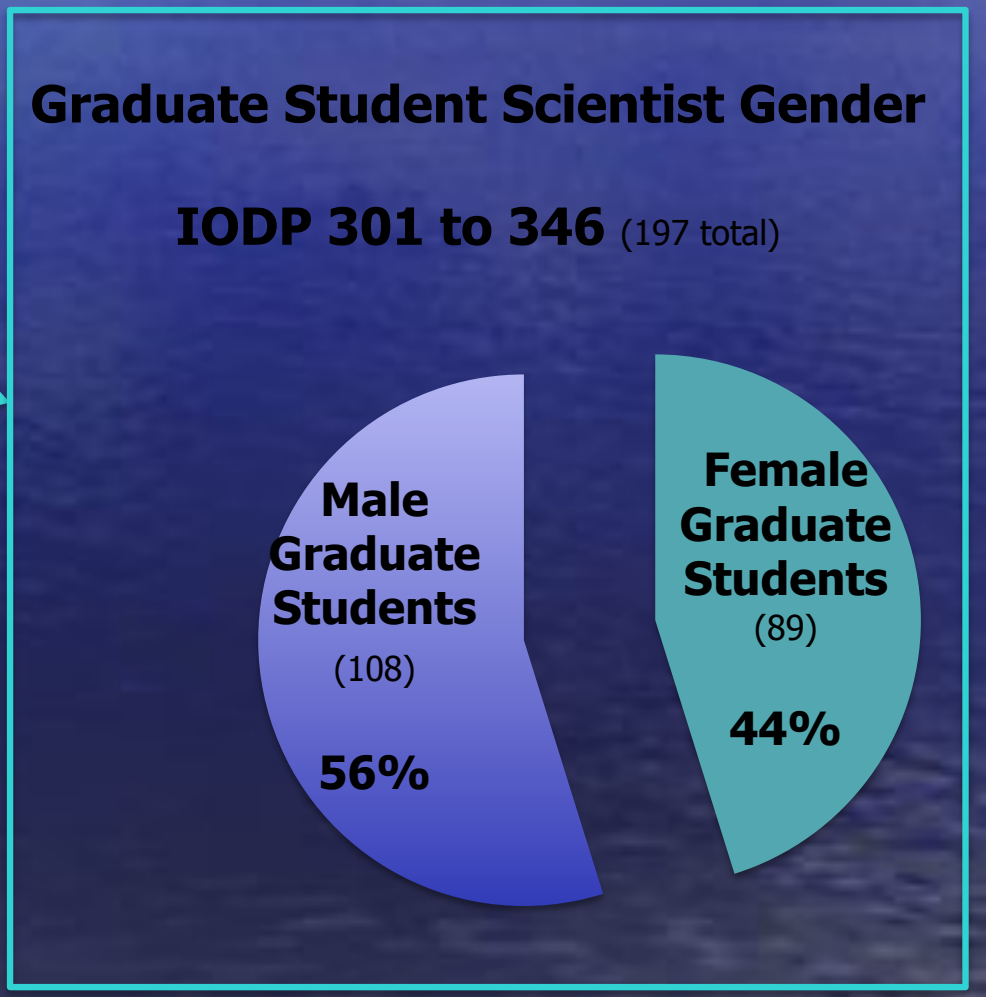
- Sophisticated labs on 3 decks (18K ft^2)
- Core reefer storage of >26K ft^3 (>6km)
- 4 Nominal 60 day Expeditions/year
- Drills holes to >2km depth using rotary drilling or sequential piston coring
- International science party of 30-32
- Technical Support staff of 17-18
- Hotel typically two bunks sharing head

Scientist Participation on JOIDES Resolution

Graduate Student Scientists

IODP Expeditions 301 to 346





Implementation in "new" IODP

Drilling Proposals Submitted to IODP

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Proposal Evaluation, Environmental Protections and Safety Panels

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***JOIDES Resolution* Facility Board**

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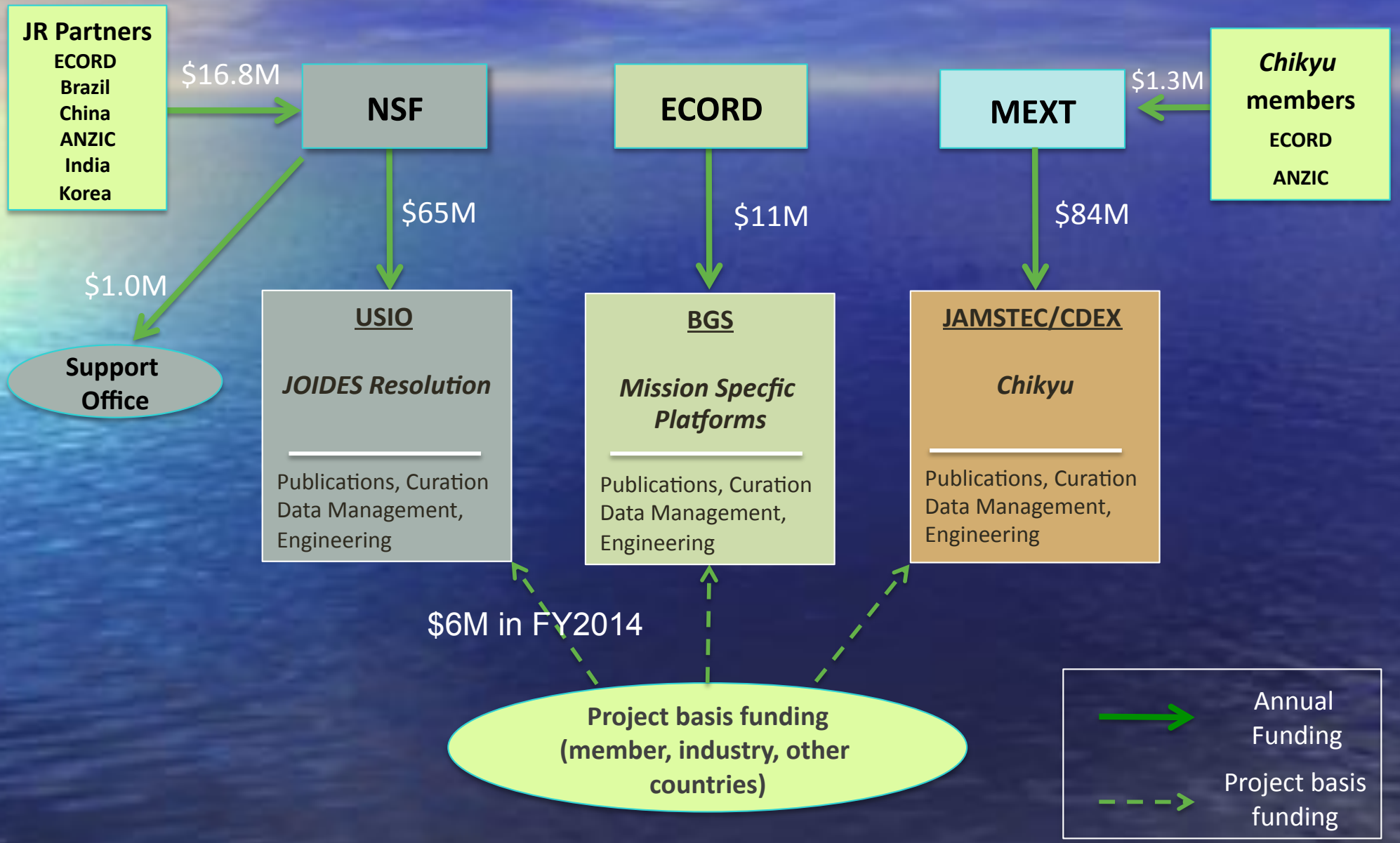
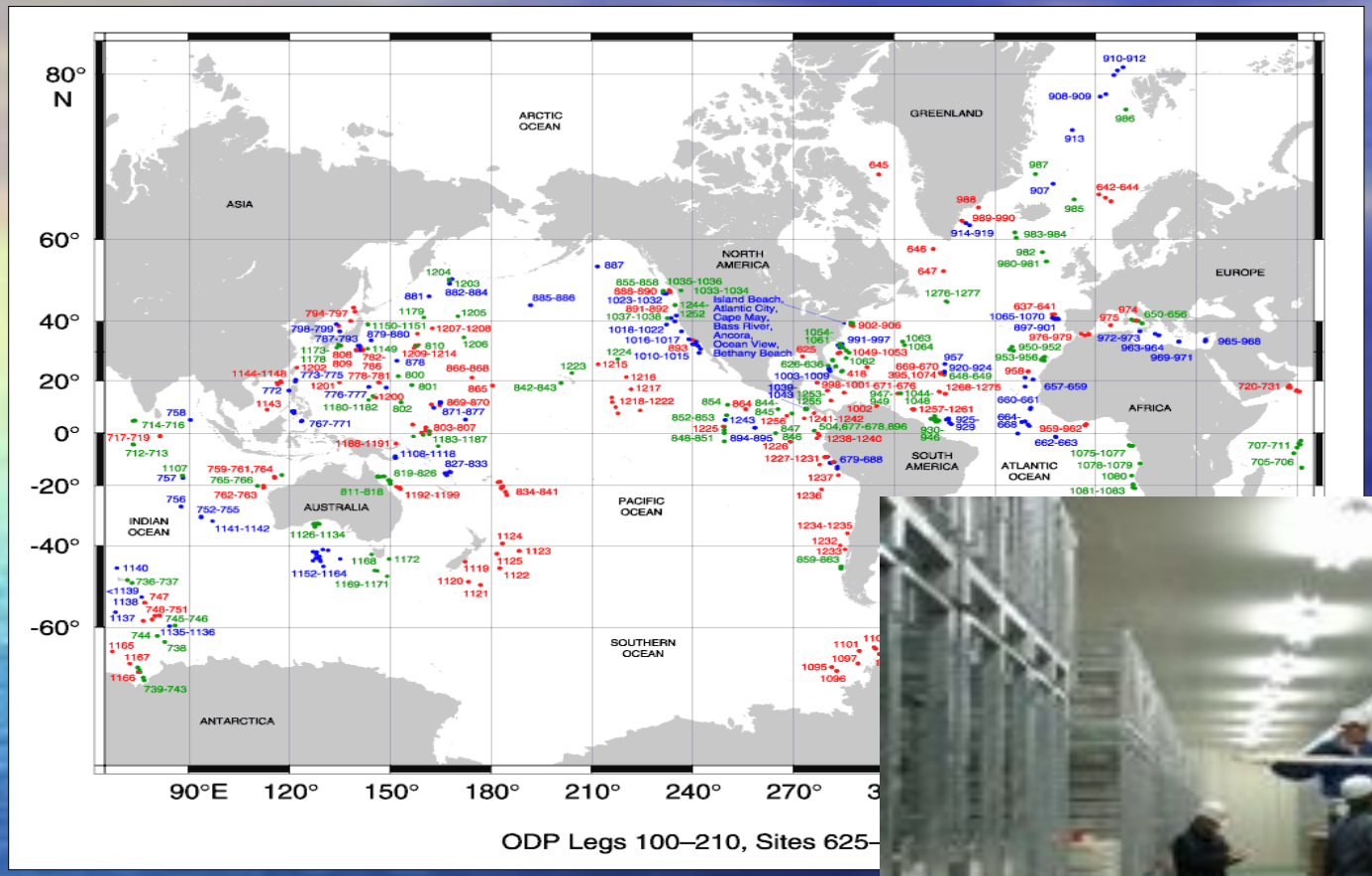
- Proposals submitted by international scientific community
- 70 international scientists evaluate science and recommend proposals for drilling
- Facility Board determines which proposals are drilled and makes policy decisions
  - Consists of international scientists, funding agencies and facility operator
- Facility operated by Texas A&M University
- US shipboard participants selected by US Science Support Program Advisory Committee

International Ocean Discovery Program

IODP Forum



DSDP, ODP, IODP Legacy Core and Data



Core samples and data are open to all!

DSDP, ODP and IODP Legacy cores (>220 km) are archived in three IODP Core Centers.


The new International Ocean Discovery Program has started: Wish us luck for the future!

Backup slides

Lessons Learned from "old" IODP

-and being implemented by NSF and its partners for the "new" IODP!

International Programs should be scalable to available funds

- Difficult to pool resources for multiple independently-provided facilities
  - Keep money flow straightforward
- Simple program structure easier to scale
  - Focus on science effectiveness
- Streamline science review/advisory system
  - Focus should be on obtaining the best scientific planning and implementation advice, not secondary objectives

Do not underestimate national influences

- IODP unable to shrink number of platforms to match resources
  - Many reasons to supply an IODP platform, not all scientific
- Legal and cultural practices vary substantially
  - Liability, labor laws differ enormously
  - Scientific culture, practices vary greatly (science review, funding agencies)
  - Program integration can be difficult to achieve

Keep intergovernmental Memoranda short, simple and flexible

- Should be broad and general
  - Goals and structure should allow scalability
  - Minimize approval issues with other governmental agencies/ministries
  - Based on trust
- Financial matters should be dealt with in annexes or appendices (varied annually)
  - Provides maximum flexibility
  - Minimizes re-approval by higher authorities

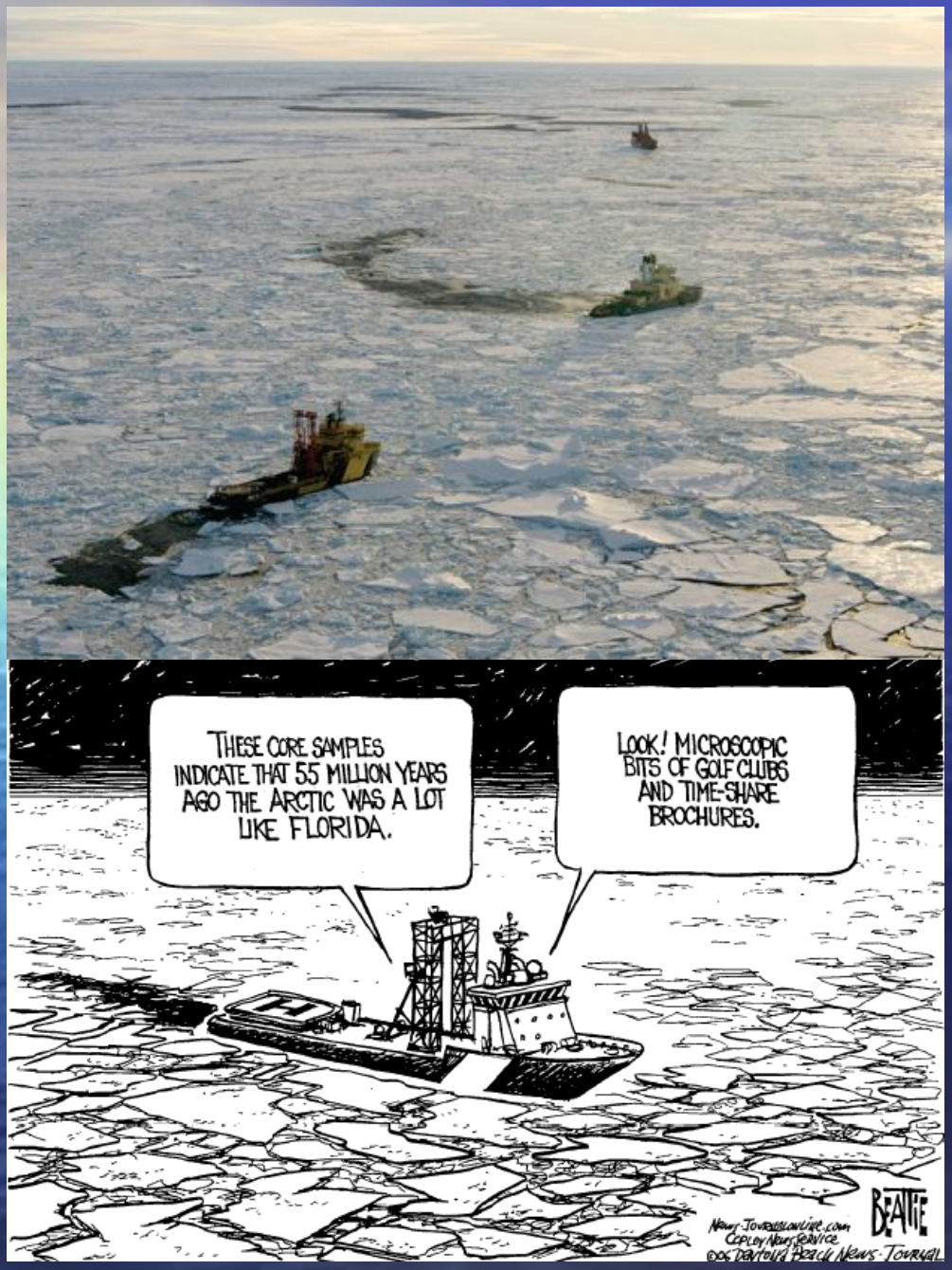
Program Leadership should be broadly-based

- Program design and ownership by all stakeholders essential; authority should follow responsibility
  - "New" IODP designed by all stakeholders
  - In "new" IODP, each platform is independently run with oversight by a Facility Board
    - Chaired by community scientist
    - Funding Agencies
    - Facility Operator
    - Scientists
- IODP Forum provides venue for over-arching discussion

Facility acquisition projects should be independent of associated program

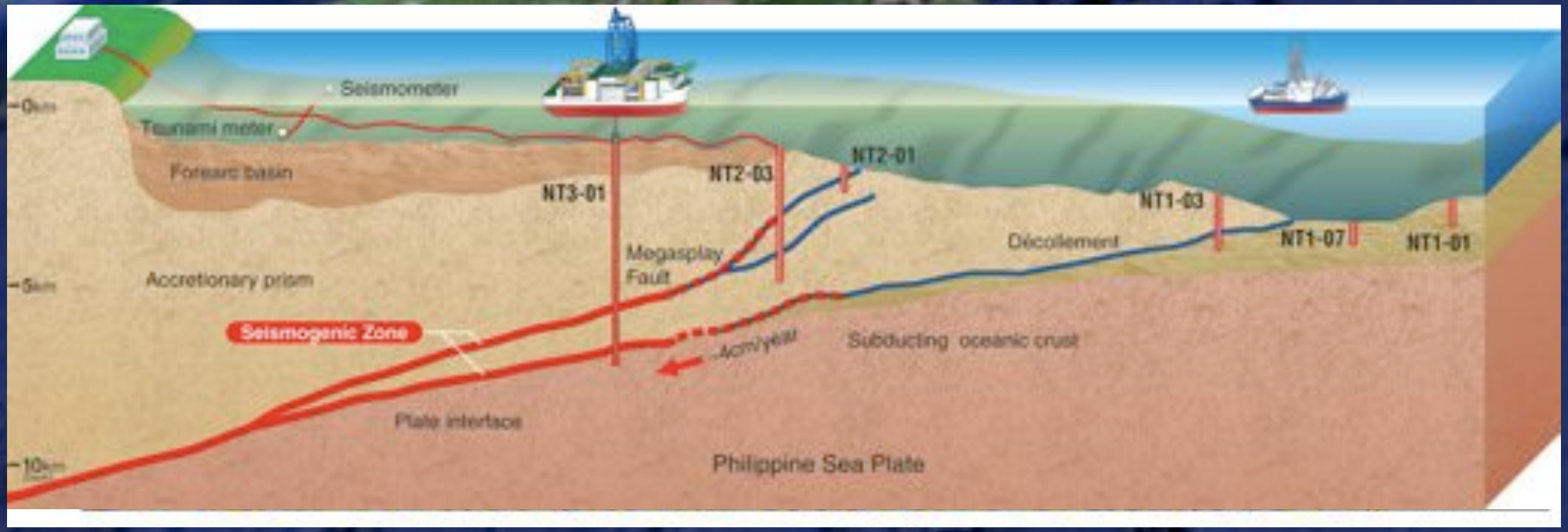
- IODP started before competitive selection of the JOIDES Resolution (JR) facility
- Subsequent NSF commitments to IODP partners caused NSF to put heavy schedule pressure on contractor during MREFC rebuilding of JR
- Funding Agencies should manage acquisition of supplied facilities independent of international programs

Arctic Coring Expedition: Expedition 302



- Recovered first deep sediment cores from the Arctic ocean seafloor
- Arctic was subtropical during Paleocene-Eocene Thermal Maximum (55 Ma)
- Documented subsequent transition between "hothouse" and "icehouse" conditions, including development of sea ice

IODP NanTroSEIZE is drilling to and instrumenting the source of big tsunami-producing earthquakes



Simplify complex facility acquisitions as much as possible

- Use separate, focused contracts or cooperative agreements for acquisition and operation
- Keep subcontract/subaward chains as short as possible
- Keep tight management approval and control of subcontract/subaward activity where appropriate