JOI/USSAC
NEWSLETTER

News from the Joint Oceanographic Institutions/U.S. Science Support Program associated with the Ocean Drilling Program • Fall 2001 • Vol. 14, No. 1

ARCTIC DREAMS

contributed by Andrea Johnson

The icy Arctic Ocean will be the last major basin reached by the scientific drilling community after thwarting researchers for many decades. Successful recovery of cores in the high Arctic could be considered the marine equivalent of landing on the moon. Still holding its secrets close, this frozen ocean may be among the first regions visited by the Integrated Ocean Drilling Program (IODP), ushering in a new era of scientific exploration.

Despite the logistical, operational, and financial challenges of implementing a drilling campaign in the Arctic, the Ocean Drilling Program's (ODP) Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES) Science Committee (SCICOM) has again shown their predilection for this science by ranking number one, for the second year in a row, proposal 533-Full2, "Paleoceanographic and Tectonic Evolution of the Central Arctic Ocean." In a consensus statement that officially recognized the scientific importance and quality of several drilling proposals requiring mission-specific platforms, including the Arctic initiative, SCICOM enthusiastically recommended implementation of these programs in the IODP (Table 1). Perhaps equally important, SCICOM formally endorsed a joint initiative between JOI/ODP and a European entity to establish a project management team to continue planning a drilling expedition to the Arctic's Lomonosov Ridge. Hopes are for the expedition to be implemented as an IODP project in the summer of 2004. Such an initiative would complement the long-term goals of the Joint European Ocean Drilling Initiative (JEODI, www.jeodi.org), which seeks to bring mission-specific capabilities to IODP to complement those contributed by the Japanese riser vessel, recently named *Chikyu*, and the US non-riser vessel.

> "...THROUGH OUR DELIBERATIONS, WE HAVE ALSO GROWN TO SHARE A VISION THAT THIS EXPEDITION, AT THE TOP OF THE WORLD, CAN BE EFFECTIVELY AND SAFELY ACHIEVED USING EXISTING, WELL-PROVEN EQUIPMENT AND SHIPS. WE AGREE THAT IT IS TIME TO PUT ASIDE THE MYTH OF THE 'CHALLENGE OF THE ARCTIC' AND BOLDLY UNDERTAKE THIS MISSION FOR THE BENEFIT OF SCIENCE AND SOCIETY."
>
> JAN BACKMAN, ARCTIC DPG

THE SCIENTIFIC VISION

Proposal 533-Full2 boldly strikes at the heart of polar mysteries (Table 2). Its proponents, led by Jan Backman of Stockholm University, seek to core the Lomonosov Ridge which spans the Arctic from Greenland to Siberia, nearly intersecting the North Pole. Their primary goals are to core the hemipelagic sediments blanketing the ridge to reconstruct the Cenozoic environmental and climatic record and to determine the composition and origin of underlying bedrock, to assess the ridge's rifting and subsidence history.

Although most of the scientific objectives could be accomplished at any one site, seven sites (Figure 1) have been proposed, primarily for contingency sake. If challenging ice or weather conditions are encountered at one site, the primary objectives could be accomplished at the others. The sites are located in international waters and are distributed between 81°N and 88°N, along the ridge crest in water depths ranging between 800 m and 1420 m. The ridge itself appears to have been rifted from the Kara/Barents Sea shelves during the Paleocene/Eocene transition. Since rifting, the ridge has subsided to its present depth and has accumulated approximately 500 m of hemipelagic sediments at a gross sedimentation rate of 1 cm/ky.

Exploring the paleoceanographic and geologic history of the Arctic basin, sometimes

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INSIDE

referred to as *mare incognitum,* has been a long-held aspiration of numerous researchers as noted in numerous scientific planning documents, including: reports of the 1981 and 1987 Conferences on Scientific Ocean Drilling (COSOD); the 1990 and 1996 ODP long-range plans; the 1999 COMPLEX report; and the 2001 *IODP Initial Science Plan.* In addition, the international Nansen Arctic Drilling Program (NAD, www.joscience.org/NAD) has been promoting the concept of Arctic scientific ocean drilling since 1989.

Setting the Stage

A surge of JOIDES Arctic activity was prompted by the submission of the Lomonosov proposal. This proposal was possible because of groundbreaking international efforts in the 1990s that resulted in the acquisition of high-quality seismic and shallow piston core data. Following positive feedback on a JOIDES pre-proposal, the proponents developed a full proposal that SCICOM ranked number one in both 2000 and 2001. Given this ascent to the top, JOIDES could no longer consider Arctic drilling in theory; it was time to face the cold, hard truth.

> "One of the major gaps in understanding the ocean paleoenvironment is that of the high-latitude regions of the oceans. This is true for the Neogene, Paleogene, and Mesozoic oceans. [The Arctic is of great] importance in a post-1983 drilling program."
>
> COSOD I, 1981, p. 83

In parallel with the ascent of this proposal, JOIDES established a Program Planning Group (PPG) in 1999 to focus on the "Arctic's Role in Global Change." The primary objective of this PPG, chaired by Martin Hovland of Statoil (Stavanger, Norway), was to develop a mature JOIDES science plan concerning those aspects of Arctic drilling that bear on global problems, particularly with respect to the climate system on timescale from decades to millions of years. The committee met three times and completed their report in March 2001. The report is available at http://joides.rsmas.miami.edu/panels/reports.html. It outlines scientific objectives and questions; discusses short- and long-term strategies for scientific drilling in the Arctic; identifies general technology needs; and considers issues that include jurisdiction, environmental impact, pollution prevention and management.

Planning

Despite the scientific merit and number one ranking of the Arctic proposal, JOIDES did not schedule the drilling program in the ODP, which, in practice, focuses its resources on the *JOIDES Resolution*, a vessel not suitable for Arctic drilling. Instead, JOIDES created an Arctic Detailed Planning Group (DPG) to investigate the operational, logistical, and financial options for drilling the Lomonosov Ridge and to develop a project management plan to achieve the proposed science. The DPG was chaired by Jan Backman, and included an international team of experts including: Margo Edwards, University of Hawaii; Tim Francis, Geotek Ltd.; Mikhail Gelfgat, Aquatic Company; Martin Hovland, Statoil; Tom Janecek, Florida State University; Wilfred Jokat, Alfred Wegener Institute; Heidi Kassens, GEOMAR; Anders Karlqvist, Swedish Polar Research Secretariat; Kate Moran, Univ. of Rhode Island; Kozo Takahashi, Kyushu University; and Chris Wiley, Fisheries and Oceans Canada.

> "In contrast to the Antarctic, which has been studied on several DSDP/ODP legs, the Arctic Ocean is nearly unknown...[and] our lack of info...is a major gap in our ability to understand and model global environmental change."
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> COSOD II, 1987, p. 40

At its first meeting, in Stockholm, in February 2001, the DPG began to address a slate of tasks that were either self-imposed or assigned by SCICOM. To conduct the field program, the DPG envisioned three options, dubbed "Arctic Armadas," each requiring multiple vessels. Subsequently, the DPG recommended their preferred scenario, which calls for the Finnish

Table 1
JOIDES SCICOM Motions
August 2001

SCICOM Motion 01-02-08: SCICOM accepts the Arctic DPG Report.

SCICOM Consensus 01-02-13: SCICOM forwards to iPC the 4 highly ranked proposals that require mission specific platforms as a SCICOM prioritization should funds become available to support mission specific platform drilling very early in IODP.

SCICOM Motion 01-02-18: SCICOM endorses the joint JOI/European initiative to set up a Lomonosov Ridge Project Management Team.

SCICOM Consensus 01-02-19: SCICOM recognizes the scientific importance and quality of several proposals intended to achieve high priority objectives of ocean drilling using mission-specific platforms. SCICOM enthusiastically supports drilling of these programs as part of a mission-specific platform component of IODP.

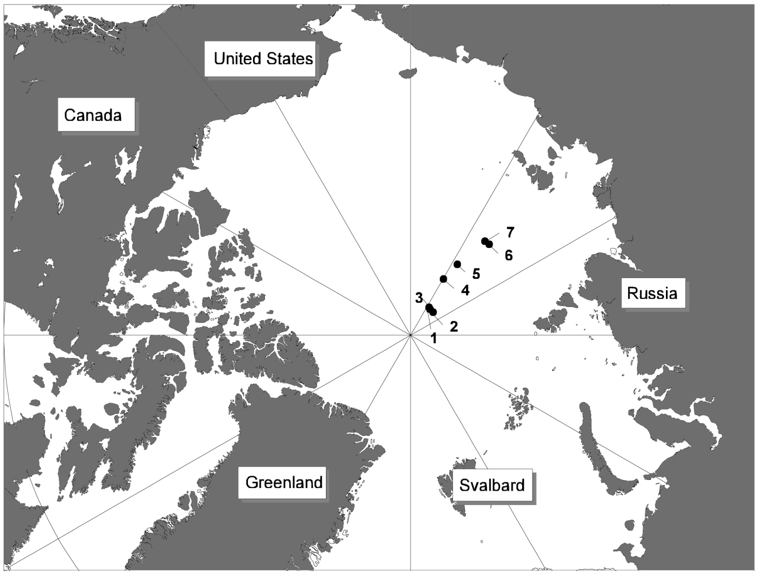

Fig. 1: Proposal 533 calls for seven drill sites along the Lomonosov Ridge in the central Arctic Ocean.

Fig. 2: The *Botnica* is the proposed drilling platform for the three-ship "Arctic Armada" necessary for Proposal 533-Full2.

Table 2
JOIDES Proposal 533-Full2, Paleoceanographic and Tectonic Evolution of the Central Arctic Ocean

Scientific Issues

- Central Arctic climate history, (including initiation and subsequent variation of sea ice).
- Oceanographic circulation and ventilation history of the Arctic Ocean.
- Composition and origin of the pre-Cenozoic core of the Lomonosov Ridge.
- Rifting and subsidence history of the Lomonosov Ridge and its links to formation of the Arctic basin.

Proponents

Jan Backman, Stockholm University, Sweden
Bernard Coakley, Tulane University, US
Margo Edwards, University of Hawai'i, US
Rene Forsberg, Nat'l. Survey & Cadastre, Denmark
Ruth Jackson, Geol. Survey Canada, Atlantic, Canada
Martin Jacobsson, Stockholm University, Sweden
Wilfried Jokat, Alfred Wegener Inst., Germany
Yngve Kristoffersen, University of Bergen, Norway
Larry Mayer, University of New Hampshire, US
Kate Moran, University of Rhode Island, US
Evgeny Musatov, VNIIOkeangeologia, Russia

vessel, *Botnica*, to serve as the dedicated drillship (Figure 2). The *Botnica*, which has a large moonpool and dynamic positioning, was built in 1998, and spends winters keeping Finland's waterways and coastlines open to commercial traffic. The Finnish government, which owns the vessel, will permit it to venture to the high Arctic in the summer months as long as there is additional icebreaker support. The remainder of the currently preferred flotilla consists of the Swedish research icebreaker, *Oden*, built in 1988, and veteran of many polar expeditions (see, for example, www.polar.se/english/expeditions/index.html), and one of several existing Russian nuclear icebreakers (see, for example, http://ourworld.compuserve.com/homepages/mnpowers/howicebr.htm). To encourage the endeavor, the Swedish Polar Research Secretariat has generously volunteered the use of the *Oden* as a contribution to the expedition.

The DPG met in June 2001 to complete its work. They envision a 35-day expedition "in the ice." This includes a 10-day roundtrip transit from a rendezvous point at the ice edge through 1000 nautical miles of ice, and 25 days on site. Optimal weather and ice conditions occur during August and early September, however, yearly variations in regional ice conditions will guide where the Armada will enter the Arctic pack ice. The entry point may be anywhere from between Svalbard and the Kara Sea, to perhaps even the Laptev Sea.

The DPG also outlined the need for a "management plan" for all phases of the project, including the drilling and transits. This plan will require ice monitoring systems that include access to satellite imagery (RADARSAT), airborne synthetic aperture radar, helicopter reconnaissance visual observations, and weather forecasts. This information is necessary to develop icebreaking and management operations (e.g., distances from the drill platform, headings for all vessels, whether to break ice or move it away) at all times during the expedition. A detailed communications plan and contingency plans (both scientific and operational) will also be needed. Other issues explored by the DPG included: costs, safety, liability, and insurance issues; environmental impact statements; as well as core-handling and laboratory procedures.

> "The Arctic…play(s) a fundamental role in the global ocean-climate system…and the complexity of this basin can only be examined by direct sampling of sediments… Recent developments have created circumstances that may, for the first time, allow scientific drilling… The history of the basin is so poorly known that we can look at the recovery of any material as a true exploration…"
> COMPLEX, 1999, p.24

The DPG's final report (available at http://joides.rsmas.miami.edu/panels/reports.html) was presented to SCICOM at their August 2001 meeting. SCICOM endorsed the DPG report and once again the Lomonosov proposal was given the premier ranking among other active JOIDES proposals. However, for reasons described above, SCICOM recommend the proposal for consideration by IODP for drilling in 2004 within the joint framework of ODP and its successor, IODP (Table 1).

Next Steps

The Lomonosov drilling proponents have forwarded their proposal to the interim Science Advisory Structure for consideration in the IODP. In closing, and returning to the subject of the joint planning initiative between JOI/ODP and a European entity, JOI—in consultation with JEODI representatives—is currently seeking the professional services of an organization to continue the planning process, as outlined and recommended in the DPG report. Funds for this activity have been approved in the ODP budget for fiscal year 2002, which began on October 1 of this year.

Sometimes dreams do come true.

The Author

Andrea Johnson, Joint Oceanographic Institutions, developed this summary article with input from John Farrell, JOI; Jan Backman, Stockholm University; and Kate Moran, University of Rhode Island.

A BRIGHT FORECAST

contributed by Dan Weill

I'm delighted to take this opportunity to introduce myself to the ODP community. I've already had the pleasure of meeting some of you at the most recent gatherings of USSAC, JOIDES-SCICOM/OPCOM and IODP-IPC, and I'm looking forward to further broadening my contacts in the community (as well as expanding the meager set of acronyms currently at my disposal)!

My professional career began with twenty years of teaching and research at Scripps and the University of Oregon. With a talented team of students and postdocs we produced an eclectic mix of research that included contributions in metamorphic and igneous petrology, interpretations of lunar samples, and models for calculating the density and viscosity of magmatic liquids. In 1983, I came to Washington, DC as a one-year "rotator" to help manage the Geosciences Program at the Department of Energy. Rotation in Washington, i.e., going around in circles, can easily turn to vocation, and I am still here.

Prior to coming on board at JOI, I served as director of a program called Instrumentation & Facilities in the Division of Earth Sciences (IF/EAR) at NSF. In the early 1980s, it was obvious that much of U.S. academic research in the geosciences lacked access to modern instrumentation, and I was fortunate to be given the opportunity by NSF to start up and develop the IF/EAR program in order to remedy the situation. When priorities are being set in science advisory circles we often hear advice about how technical and engineering developments should "… follow the science." While that is good advice in many instances, the reverse can also be true. Technological developments, often not originally intended for the purpose, can lead a science to major advances. Examples of technology leading the geosciences are easy to come by. In addition to the ubiquitous dependence on computers, our science has been propelled by developments in GPS technology, new generations of chemical and isotopic probes, digital broadband seismometers, ultrahigh pressure diamond cells capable of experimentally reproducing the physical conditions of the Earth's mantle and core, and synchrotron X-ray beams of unrivalled brilliance. ODP's continually improving capabilities in drilling, coring, logging, and downhole observational systems obviously belong on any such list.

"I WANTED TO RESPOND TO THE CHALLENGE OF HELPING THE COMMUNITY NAVIGATE THE TRANSITION FROM ODP TO AN EVEN MORE AMBITIOUS IODP AGENDA"

DR. DAN WEILL, THE NEW DIRECTOR OF THE OCEAN DRILLING PROGRAM, JOI

Since its inception in 1985, the IF/EAR program has responded favorably to over a thousand proposals requesting grants to purchase or build a wide range of lab and field instruments for use by researchers and their students. The program has also supported over fifty technicians to help run the more complex of these instruments through a series of five-year grants designed to seed "hard money" technician positions at research institutions. Some instrument systems are sufficiently large and expensive to warrant the creation of regional or national facilities, and the IF/EAR program also supports facilities such as the Global Seismographic Network and the PASSCAL pool of portable seismometers managed by the Incorporated Research Institutions for Seismology, the University NAVSTAR Consortium (UNAVCO) for GPS based geosciences applications, the WHOI and UCLA ion microprobe centers, and others. Last year, I began to have illusions that the IF/EAR program had accomplished its goals, and, early in 2001, it seemed appropriate to leave NSF and turn the program over to my successor before complacency turned me from science-mole-in-the-Washington-bureaucracy to smug bureaucrat.

So, after a brief flirtation with retirement and some pleasant lunches with my wife, here I am at JOI. What brought me here? The excellent reputation of ODP as a highly productive "big science" program was certainly a factor. Another was the opportunity to help the program finish its active drilling phase with scientific results worthy of its many previous successes and to guide it through a closing phase that will ensure a legacy of intellectual as well as physical assets. Lastly, I wanted to respond to the challenge of helping the community navigate the transition from ODP to an even more ambitious IODP agenda.

These tasks will not be easy, but, after having recently observed the dedication, expertise and sound judgment of the JOIDES, USSAC and iPC committees as they go about the challenging work of advising such a complex set of programs, I am confident about tomorrow's forecast of " … a beautiful ODP sunset … followed by a bright IODP sunrise!"

See you around.

A Regional Context for Hole 735B

contributed by Allegra Hosford and Maurice Tivey

Ocean Drilling Program Hole 735B (Legs 118 and 176) and the Atlantis Bank platform on which it sits are the most thoroughly studied features along the ultra-slow spreading Southwest Indian Ridge (SWIR). Drilled to a below-seafloor depth of 1.5km, Hole 735B remains the only deep hole in oceanic gabbro. Yet, because the pre-drilling site survey was limited to a narrow strip of seafloor, core-based interpretations lack the regional context of the segment-scale processes and tectonic evolution of the drill site and Atlantis Bank.

In October-November 1998 and September 2000, two joint JAMSTEC-WHOI cruises to the SWIR conducted diving and geophysical programs near Atlantis Bank. The surveys encompassed the two ridge segments between the Atlantis II (57°E) and Novara (58°40'E) fracture zones, and extended in the spreading direction to 25 Myr-old crust on both the African and Antarctic plates. A JOI/USSSP Site Augmentation Project was funded to analyze these regional geophysical data to provide a broader context in which to further evaluate the drilling results from Hole 735B.

TECTONIC SETTING

Spreading ridge segmentation in the survey area has remained remarkably stable over 25 Myr, with two long-lived ridge segments, two transform offsets, and one 15 km wide non-transform discontinuity separating the segments (Figure 1a). A near-instantaneous change in plate-motion occurred at 19.5 Ma, when the spreading direction rotated counterclockwise by 10°. Atlantis Bank formed between 13 and 9.5 Ma on the Antarctic plate (south flank) at the intersection of the western spreading center and the active portion of the Atlantis II fracture zone. Atlantis Bank is one of eight massifs emplaced adjacent to the active portion of the fracture zone since 25 Ma, but it is two to four times larger than the other massifs in all dimensions. No obvious change in segmentation is associated with the uplift of Atlantis Bank, and thus it appears that its uplift was due to local factors. These may include plate flexure due to transtension across the large-offset transform and/or unroofing along a large-scale and long-lived detachment fault. Seafloor topography and magnetic isochrons were disrupted within the eastern ridge segment between 5.5-3 Ma when a propagating rift migrated from west to east (dashed line, Figure 1).

SPREADING HISTORY

Magnetic lineations in the survey area trend orthogonal to the north-south spreading direction. The lineated anomalies are consistent and identifiable over the study area, including Atlantis Bank where drilling and dredging indicate that the upper, volcanic crust is absent. The total spreading rate of 14 km/Myr has remained nearly constant since at least 25 Ma, but crustal accretion has been highly asymmetric, with half-rates of 8.5 and 5.5 km/Myr on the Antarctic (south) and African (north) plates, respectively. This asymmetry is apparent in the derived crustal age map (Figure 1b). Such long-term accretion asymmetry is unusual in the global ridge system. The magnetic age of the 735B site is 11.8 ± 0.2 Myr.

CRUSTAL MAGNETIZATION

Axial crustal magnetization is inversely correlated with seafloor depth at both ridge segments. This pattern is opposite to observations at the Mid-Atlantic Ridge and the East Pacific Rise, but is the same as observations farther west on the SWIR and on the ultra-slow spreading Mohns Ridge. The observed axial crustal magnetization can be explained by a two-layer magnetic source consisting of a constant thickness upper crust underlain by a variable thickness lower crust, a model that is generally consistent with seismic data collected at the western segment. Off-axis, magnetization amplitudes decay by 72% between the ridge axis and 20-Myr old crust. This decay occurs more rapidly during the first 10 Myr following emplacement than during the subsequent 10 Myr.

Magnetization amplitudes measured along isochrons off-axis are higher at segment ends than at segment centers, suggestive of the presence of an induced component of magnetization. A similar pattern is observed at the Mid-Atlantic Ridge. Paleomagnetic measurements on Hole 735B gabbros indicate that the

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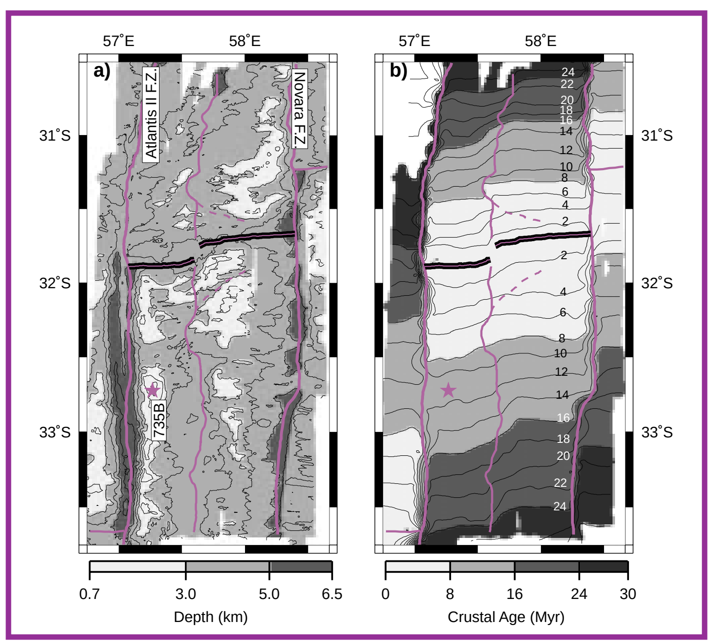


Fig. 1: a) Multibeam bathymetry data in the study area. The grid resolution is 500 m and the contour interval is 1 km. The star marks the location of ODP Hole 735B on Atlantis Bank. Double heavy lines mark the ridge axes and heavy single lines mark the middle of the fracture zone valleys and the off-axis trace of the non-transform discontinuity. Dashed line marks the location of a short-lived propagating rift. b) Contour map of crustal age grid derived from dense magnetic anomaly identifications. Grid resolution is 1 km and contour interval is 2 Myr. Heavy lines and star are as in Figure 1a.

CORAL DRILLING REQUIRES FIT-TO-MISSION APPROACH

contributed by Terry Quinn

The International Workshop on Submerged Coral Drilling, co-sponsored by the National Science Foundation and JOI/USSSP, was held in St. Pete Beach, Florida, from September 27-30, 2000. Organized by Terry Quinn and Sandy Tudhope, with the assistance of Larry Edwards, Rick Fairbanks, Michael Gagan, and Fred Taylor, the workshop brought together 39 scientists and engineers from 8 countries. The workshop's principal objective was to allow the coral-based scientific, imaging and geotechnical communities to identify how their respective capabilities could be better integrated to solve the pressing scientific issues that can uniquely be addressed via submerged coral drilling. The initial report is available online at www.marine.usf.edu/coraldrilling/index.html and a final version will be available from JOI in the near future.

WORKSHOP OVERVIEW

Annually-banded massive corals and their associated reefal deposits have unique attributes that make them exceptional archives of environmental change in the tropics through the Late Quaternary. These attributes include our ability to directly date corals by high-precision, U-series techniques; the proven ability of large corals to yield high-resolution (e.g., ~monthly) multidecade- to multicentury-long records of past climate; and the utility of corals and associated deposits as recorders of past sea levels. Workshop participants identified 4 overarching scientific issues that can be addressed by drilling submerged coral reefs:

1. What is the nature and magnitude of tropical climate change on millennial to interglacial timescales?
2. How do the dominant modes of tropical climate variability respond to changing climatic boundary conditions?
3. What is the timing and magnitude of sea level variations during the Late Quaternary? To what extent does sea level respond to millennial-scale climate variability?
4. What is the nature of the radiocarbon timescale between 12 Ka BP to 40 Ka BP, a time when the abundance of fossil trees are insufficient to produce a radiocarbon calibration based on tree rings?

These issues, along with other compelling questions concerning fluid flow in reefs and reef ecology, require that submerged coral reefs be successfully cored. This in turn requires operations in shallow water depths (0-200 m) with core penetration that is generally tens of meters to a few hundred meters. Lively discussion among the workshop participants focused on the issue of core recovery in the reefal environment. Complete core recovery clearly maximizes the potential scientific return on the drilling. However, it is important to note that a drilling program that focuses on recovering only *in situ* coral heads would meet most scientific objectives related to climate, sea level and radiocarbon calibration. A cost/benefit analysis should be performed for site-specific projects relative to the merits of the vastly different approaches to core recovery in the reefal environment.

The first traditional challenge of ocean drilling is to identify the drilling target, although this challenge may not be as critical in submerged coral drilling as is often assumed. A suite of reasonably priced remote-sensing technologies is available to the academic community, ranging from multibeam sonar and side-scan sonar, to very high-resolution (i.e., meter-scale horizontal resolution and sub-meter scale vertical resolution) seismic-reflection profiling. A technology called chirp sonar is now being used extensively in siliciclastic environments, where it provides maximum horizontal resolution of 25 cm while providing ~30 m of penetration in unconsolidated shelf siliciclastics. It would be valuable to see if the chirp system could be a viable tool in submerged coral drilling site surveys.

Submerged coral drilling may involve a completely different approach to pre-drilling target identification and real-time core acquisition compared to the more traditional ocean drilling methods. Land-based drilling on uplifted carbonate islands has unequivocally demonstrated that buried coral heads can be efficiently recovered by using the principles of coral-reef geomorphology even in the absence of geoacoustical surveys. Furthermore, such land-based drilling programs have often used a drilling strategy that emphasized multiple cores, in preference to single (or a few) deeper cores. The scientific rewards for recovering *in situ* coral heads are so large that a few "dry holes" (i.e., those devoid of coral heads) do not threaten the overall science objectives. Submerged coral drilling is likely to require multiple sites in close proximity, rather than a single deep hole drilled by a ship kept on station for many days to weeks. Any marine-based drilling program for coral reefs must be flexible enough to allow numerous station changes, conducted as quickly and efficiently as possible. Thus, drilling submerged corals truly requires a dedicated "fit-to-mission" philosophy.

The second, and perhaps more daunting, challenge facing a successful coring campaign of submerged coral reefs is the deployment of the "proper tool for the job." Maintaining station, maintaining proper weight on the drill bit, and heave compensation pose significant challenges to drilling in shallow water (< 200 m). Workshop participants identified 17 potential platforms for conducting geotechnical sampling/coring operations ranging from barges, vessels and drillships to seabed frames and jack-up rigs.

Barges, vessels and drillships maintain station in shallow-water by 4-point anchoring or by dynamic positioning (DP), although anchoring is more likely in water depths < 75 m. Seabed frames and jack-up platforms minimize problems associated with maintaining station, weight on bit and heave, although there are limitations with some platforms in terms of drilling multiple holes in close proximity. A "mining- or mineral-type" drill rig may be best suited for use in a submerged coral drilling program because of the coral-reef lithologies and the science objectives of drilling and recovery of coral heads. This type of drill rig commonly uses a diamond coring system with thin kerf bits, small cores and wireline sampling. For diamond coring with core size HQ (~60 mm) or larger, the diamond core barrel can be interchanged with piston, push, punch or percussion samplers without pulling the drill string. Diamond coring is especially sensitive to any changes in weight on bit, therefore proper heave compensation is critical to successful coring. When drilling is performed from a platform positioned at the sea surface, a riser is likely needed to provide both lateral support to the smaller diameter mining drill rods and to make it possible to re-enter the holes during the drilling operations. Versatility and portability are critical attributes of any platform used for submerged coral drilling.

Workshop Recommendations

1. The strongest possible support for Europe's potential contribution of alternative platforms to IODP to complement the contributions of the U.S. (non-riser drillship) and Japan (riser drillship).
2. The compelling scientific rewards of shallow-water drilling, especially submerged coral drilling, justifies the inclusion of alternate platforms as an integral part of IODP. ODP/IODP's vast experience in proposal and project management, core handling and repositories, technical support, publication protocols, etc. provide a powerful incentive for the submerged coral drilling community to participate.
3. The determination of the most appropriate platform to drill highly ranked scientific proposals should be made by a "geotechnical committee" consisting of scientists and engineers. In such a system, it is envisioned that principal investigators (PIs) whose drilling objectives require alternate platforms would concentrate their efforts on the science in the proposal. The geotechnical committee would work with the PIs of highly ranked proposals to determine all the drilling parameters and variables needed to form a "request for drilling bids." The global geotechnical drilling community could then provide a series of bids for the successful completion of the scientific objectives. The geotechnical committee would evaluate the bids and recommend the best drilling solution: riser drill ship, non-riser drill ship or alternate platform. Such a system would provide immediate benefit to siliciclastic and carbonate margin communities, as well as to the submerged coral drilling community. Perhaps of equal importance, such a system would permit the two other IODP drillships to concentrate their efforts where they are best suited (e.g., deep water/deep penetration/piston coring), while leaving shallow-water drilling to platforms specifically designed for drilling in these waters.
4. Release time for an ODP engineer to consult on drilling proposals involving alternate platforms.
5. Promote/facilitate an integrated approach to site-survey work in remote areas of the tropics to benefit from economy of scale.
6. Development of an international tropical science initiative. The IODP should play the leading role in the ocean portion of this new initiative.
7. Establish official liaison relations with other working groups that require alternative platforms (e.g., SHALDRILL, MARGINS, ARTS, PAGES-CLIVAR, etc.).
8. Establish a web page to facilitate proposal generation by providing a one-stop location for information required for proposals involving submerged coral drilling.

Concluding Remarks

The Deep Sea Drilling Project (DSDP) and ODP have been, and IODP will be, the preeminent program(s) for the drilling and recovery of ocean sediments and rocks. DSDP and ODP have not traditionally been involved in shallow-water science—especially submerged coral reef drilling—largely because of the technical and financial limitations of a single-ship program, despite the significant scientific returns that such drilling would provide. A new era in ocean drilling is upon us; IODP needs to embrace a "fit-to-mission" approach so that drilling proposals having high scientific merit will not be set aside based on perceived technical limitations.

Workshop participants endorsed the notion that submerged coral reef drilling could fall under the purview of IODP because decades of previous ocean drilling have resulted in a system that is well equipped to manage science proposals, funding, sample handling and storage, travel and logistics, etc. However, workshop participants also recognized that drilling platforms separate from a "*JOIDES Resolution*-type" drillship are required for a successful submerged coral drilling program. The challenge facing IODP is to be flexible enough to drill the most highly ranked scientific proposals, regardless of the platform required to accomplish their scientific objectives, provided that they are reasonable from an economic perspective. Workshop participants strongly endorsed the concept of a tripartite drilling approach for the IODP consisting of a non-riser drillship, riser drillship and a suite of alternative platforms.

The Author

Terry Quinn is an Associate Professor at the College of Marine Science, University of South Florida, St. Petersburg.

Spreading the Word

contributed by Kasey White

During this transition from ODP to IODP, many efforts are underway to build support for ocean drilling by highlighting its past accomplishments and future areas of exploration. When asked about ODP's legacy, scientists may respond with statements about understanding fluid fluxes in subduction zones, hydrothermal mineralization, or *in situ* measurements of methane hydrates. Although important findings, these phrases usually make the eyes of nonscientists glaze over, wondering how such things could impact life outside a laboratory. Yet, as you well know, these findings are very relevant to everyday life, providing information on natural hazards, mineral exploration, and energy supplies.

My job at JOI is to translate and publicize ODP science in a language and context understandable to nonscientists. I am very excited to take on this role, which is made easier by the amount of interesting science produced by the ODP. With degrees in Environmental Science and Policy, my previous jobs focused on bridging the gap between science and government. Both at the American Geological Institute's Government Affairs Program and the United Nations Intergovernmental Panel on Climate Change, I worked to provide accurate scientific information to policymakers, so that they could make informed decisions. I plan to use my experience from these jobs to spread the word about ODP through the media, publications, and events.

ODP in the News

JOI continues to place ODP stories in the popular press, a complement to the many journal articles produced by ODP scientists. Recent press releases announced Daniel Weill as the new ODP Director and featured preliminary findings of current legs. These announcements have appeared in many publications, including *Geotimes, Oil and Gas Journal*, and *Offshore Magazine*. We plan to write press releases at the end of most legs to keep the media apprised of current developments.

We are also responding to specific requests for stories. Both the July and August 2001 issues of *Geotimes* featured ODP. The July issue contained highlights of ODP research from the past year written by ODP/TAMU's Manager of Science Services, Tom Davies. The August cover story, "ODP: International Earth Science," discussed both how ODP's scientific advisory structure has helped it successfully navigate politics across international borders and specifics of ODP's scientific contributions.

Greatest Hits, Volume 2

In addition to writing stories on current issues, we are preparing documents with a historical perspective on ODP. At the request of the JOIDES Executive Committee, the JOI and JOIDES offices are preparing a sequel to *ODP's Greatest Hits*, which will contain highlights of ODP research. We will synthesize contributions from the international scientific community to illustrate the cumulative contributions of ODP. Once completed, these articles will be available on the web for a variety of uses, including communicating with policymakers, the public, and the press.

Congressional Outreach

One important group of nonscientists to reach is the one that holds our purse strings — Congress. We are focusing our message to lawmakers on how ODP research has contributed to understanding policy issues, including climate change, energy, and resource development. In addition to creating documents geared towards policymakers, we are increasing our presence on Capitol Hill. JOI has participated in several events in Washington recently, including the Coalition for National Science Funding exhibit in June and a World Oceans Day event in September.

On October 10, JOI joined with the bipartisan House Oceans Caucus to cosponsor a reception on Capitol Hill. The event featured displays on ODP research and IODP by Nick Pisias, Ken Miller, Steve D'Hondt, Robert Zierenberg, Susan Humphris, Peter Flemings, Jerry Dickens, and JOI staff. House Oceans Caucus Co-Chair Tom Allen (D-ME) welcomed attendees to the reception, and JOI President Steve Bohlen and Caucus Co-Chair Jim Greenwood (R-PA) spoke about the importance of ODP and ocean research to the nation. The reception, which was well attended by congressional staff and the scientific community, was the culmination of two days of scientists' visits to nearly 20 offices of key congressional members and committee staff to discuss the importance of scientific ocean drilling.

Future Activities—Your Involvement Needed

To continue the success of JOI's outreach efforts, we need your involvement. If you have ideas or are interested in participating in future activities, please do not hesitate to contact me. One easy way to support ODP and IODP is to meet with your Congressional delegation the next time you visit Washington, DC. We are happy to set up meetings and provide information to make your visit easier. I look forward to working with you to help increase ODP's legacy both inside and outside the science community.

To contact Kasey White, please email her at kwhite@joiscience.org or send her a letter at the JOI address.

Navigating Political Waters

JOI/House Oceans Caucus Reception

On October 10, 2001, seven ODP scientists accompanied by JOI staff visited the Hill with science posters and plainspeak: Susan Humphris, WHOI; Rob Zierenberg, UCDavis; Steve D'Hondt, URI; Steve Bohlen, JOI; Ken Miller, Rutgers; Peter Flemings, PennState; Jerry Dickens, Rice; and Nick Pisias, OSU. You may not recognize some of them in ties...

"One easy way to support ODP and IODP is to meet with your Congressional delegation the next time you visit Washington, DC. We are happy to set up meetings and provide information to make your visit easier."

—Kasey White, Outreach Coordinator, JOI

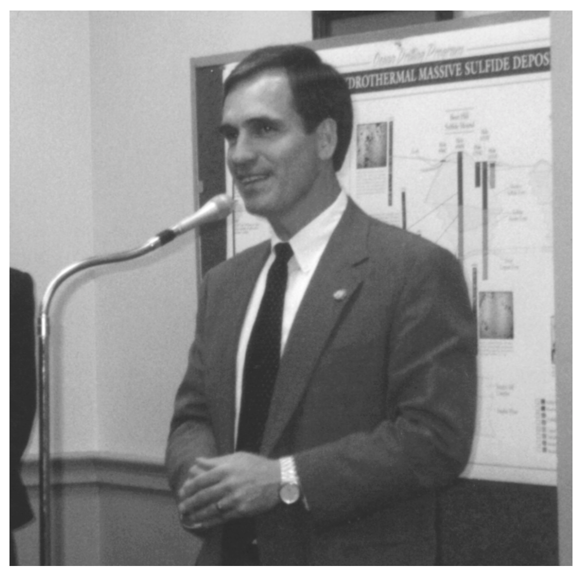
"If you scale the Earth's oceans to the area of the [National] Mall, the cores extracted during drilling would be much thinner than the narrowest hypodermic needle. Take 2000 of those and push them into any surface on the Mall. Now, using those samples, describe the Mall to me.

— Steven Bohlen, President, JOI

Speaking to congressional representatives and staff

Steve Bohlen meets with Representative Tom Allen and Sea Grant Fellow, Deirdre Gilbert.

Steve Bohlen briefs House Oceans Caucus Co-Chair Jim Greenwood on the benefits of scientific ocean drilling programs.



House Oceans Caucus Co-Chair Tom Allen welcomes attendees.

Drill Bits

New JOI Email and Website

JOI's email address—which previously ended in "brook.edu"—has changed to end in "joiscience.org." The new address for general inquiries is now "info@joiscience.org." The old JOI address will continue to function for the next several months, however, JOI requests that you note this change and begin using the new address. The JOI website address has also changed to coordinate with the new email address. It is now "www.joiscience.org."

DOE Proposal a "Go"

In October 2001, the United States Department of Energy (DoE), National Energy Technology Laboratory (NETL) awarded JOI/ODP approximately $1 million in support of the proposal, "*In Situ* Sampling and Characterization of Naturally Occurring Marine Methane Hydrate using the D/V *JOIDES Resolution*." Frank Rack, JOI's Assistant Director of ODP and USSSP, coordinated the submission of this proposal in response to a DoE solicitation on "Methane Hydrates." Several members of the JOIDES scientific community and industry representatives assisted in preparing this proposal by writing letters of support and by providing detailed information about the research requirements of the gas hydrate community. Gerald Dickens (Rice University) is a co-proponent on this proposal along with JOI, TAMU, and LDEO.

The proposal requested funds to support upgrades to downhole tools used by ODP to sample and characterize marine gas hydrates (e.g., Pressure Core Sampler (PCS), ODP memory tools), and new equipment that could be used for this purpose (e.g., G/GI seismic guns, infrared thermal imaging system, PCS gas manifold system, and modifications to the FUGRO piezoprobe tool for use with the ODP bottom hole assembly). These tools will be used on ODP Legs 201 and 204 to support the leg objectives and to characterize hydrates found in these environments.

Final ODP Legs Scheduled

In August 2001, the JOIDES Science Committee scheduled the final year of ODP operations for Legs 206 through 210. The program's final leg, Newfoundland Margin, is scheduled to end on September 9, 2003. Following a portcall in St. John's, the current plan calls for a transit of the *JOIDES Resolution* to Galveston, Texas for demobilization during the last week of September. However, until then, lots of exciting science is planned, so stay tuned. Keir Becker , JOIDES SCICOM Chair, has written an article that describes the scheduled 2003 legs in detail. It will soon appear in the American Geophysical Union's weekly newspaper, *Eos*. For additional information see the ship schedule on the facing page and visit the ODP website (www.oceandrilling.org).

Earth Science Week 2001

Once again, JOI/USSSP participated in Earth Science Week (October 7-13, 2001) which is an annual event organized by the American Geological Institute (AGI). JOI/USSSP provided educational resources for the Earth Science Week information kit that is distributed by AGI to educators and other interested persons. JOI/USSSP's contributions included 5,000 *Gateways to Glaciation* CD ROMs that were used along with extra *Mountains to Monsoons* CDs and *Blast from the Past* educational posters that were donated for the event in 2000. You may request kits from AGI using an online form: www.earthscienceworld.org/week/requestform.html.

Co-chiefs Meet in DC

On April 2-3, 2001, JOI hosted the bi-annual Co-chief Review Meeting in Washington, DC. The meeting was attended by co-chiefs scientists from ODP Legs 181 through 194, as well as by representatives from JOIDES, JOI and all of its subcontractors. The co-chiefs commented positively on their ODP experience, from the initial planning with JOIDES and the Site Survey Databank, to the operational phase with TAMU and LDEO, to the post-cruise research period. Detailed minutes from the review, with specific action items, have been prepared by JOI and forwarded to the appropriate parties for consideration and action.

JOI Expands

JOI recently welcomed two new corporate members into the fold. At their June 2001 meeting, the JOI Board of Governors voted to accept Florida State University and Stanford University as JOI members. The institutions' membership into JOI was made official on July 1, 2001. The JOI membership now stands at 16 institutions.

Student Trainee Openings

The ODP Undergraduate Student Trainee Program has openings for trainees on upcoming ODP Leg 203 (Equatorial Pacific ION) in June-July 2002 and Leg 205 (Costa Rica) in September-October 2002. This program, which is open to students from all ODP partner countries, provides a unique educational opportunity to participate in a scientific cruise aboard the *JOIDES Resolution*. To be eligible, participants must be undergraduate students at the time of the leg. More information about the program is available on the repective JOI and ODP websites: www.joiscience.org/USSSP/StudentTrainee/StudTrain.html and www.oceandrilling.org/Participating/StudentTrain.html.

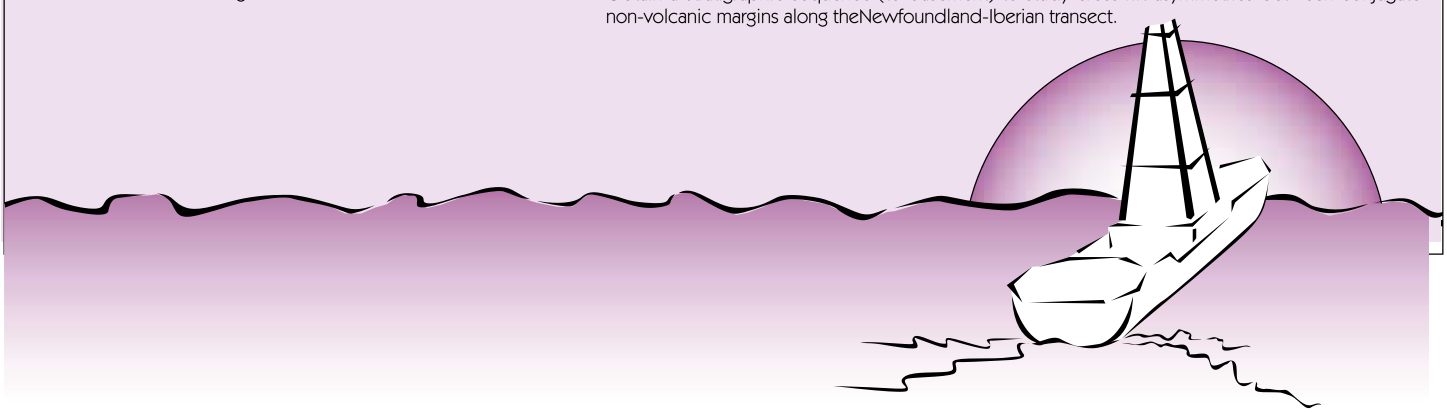
Seven students have participated in the program to date, with three being from the United States. Ericka Olsen, University of Pennsylvania, participated on Leg 186; Stan Hammon, University of Texas, Dallas, participated on Leg 195; and Jill Gudding, Michigan State University , participated on Leg 197. Student reviews of the program have been glowing.

US students interested in the program are encouraged to contact Andrea Johnson at JOI (ajohnson@joiscience.org).

Operations Schedule for ODP Legs 195-210

For more information: www.oceandrilling.org/Cruises/Cruises.html

LEG	REGION	CO-CHIEFS	DEPARTURE PORT	DEPARTURE DATE	SCIENTIFIC OBJECTIVES
195	Mariana/ West Pacific ION	Shinohara Salisbury	Guam	3/01	Emplace a seismic observatory to study earthquake dynamics, plate subduction processes, formation of island arcs, and their relation to mantle convection.
196	Nankai II	Becker Mikada, & Moore	Keelung	5/01	Conduct Logging-While-Drilling and to install CORK hydrologic observatories at sites drilled during Legs 131 and 190. Leg 196 is the second part of a two-leg Nankai Trough program.
197	Hotspots	Tarduno Duncan	Yokohama	7/01	Penetrate basement (150-250 m) to obtain samples for paleomagnetic tests to determine the motion of the Hawaiian hotspot during the formation of the Emperor Seamounts.
198	Shatsky	Bralower Premoli Silva	Yokohama	8/01	Explore extreme warmth and climatic transitions, both long-term and abrupt, in the Cretaceous and Paleogene by drilling a depth transect on Shatsky Rise, central Pacific.
199	Paleogene	Lyle Wilson	Honolulu	10/01	Extend high-quality paleoceanographic records, using APC/XCB cores, back to the Eocene and to study the "hot house world" (hydrothermal activity, equatorial circulation, productivity, etc.).
200	H_2O	Stephen Kasahara	Honolulu	12/01	Create a long-term observatory to: 1) study the fast-spreading Pacific crust, 2) serve as a high-priority link in the Ocean Seismic Network, 3) monitor geophysical and geochemical experiments in the crust.
201	Peru	D'Hondt Jorgensen	San Diego	1/02	Test whether various sedimentary geochemical regimes are characterized by different subsurface microbial communities—or merely by different degrees and kinds of community activity.
202	SE Paleoceanog.	Mix Tiedemann	Valparaiso	4/02	Study Neogene and older sediments in latitudinal/depth transects of SE Pacific topographic rises to assess history of boundary currents and millennial-scale climate variability.
203	Eq. Pacific ION	Orcutt Schultz	Balboa	6/02	Emplace a seismic observatory in the western equatorial Pacific, a high-priority site for the International Ocean Network (ION) and the Ocean Seismic Network (OSN).
204	Gas Hydrates	Trehu Bohrmann	San Francisco	7/02	Investigate the formation and physical properties of gas hydrates, as well as to calibrate their volume estimates, evaluate their role in slope stability, and identify paleo-proxies for methane release.
205	Costa Rica	Morris Villinger	San Diego	9/02	Test fluid flow and subduction flux models, and understand the processes associated with the seismogenic zone and workings of the subduction factory.
206	Fast Spread Crust	TBN	Balboa	11/02	Penetrate a complete upper crustal section to the gabbro in 15 Ma oceanic crust on a superfast spreading ridge in the eastern Pacific Ocean (the first of a proposed two-leg program).
207	Demerara Rise	TBN	Barbados	1/02	Recover cores from a transect of sites to study extinctions linked to massive perturbations of the global carbon cycle and extreme changes in Earth's climate in the Cretaceous and Paleogene.
208	Walvis Ridge	TBN	Rio de Janeiro	3/02	Obtain high-resolution cores for reconstructing paleoceanographic characteristics of South Atlantic deep and surface waters during prominent episodes of early Cenozoic extreme climate change
209	MAR Peridotite	TBN	Rio de Janeiro	5/02	Sample the upper mantle in a magma-starved area of a slow spreading ridge and characterize mantle deformation patterns, residual peridotite composition, melt migration and hydrothermal alteration.
210	Newfoundland Marg	TBN	Bermuda	7/02	Obtain a stratigraphic sequence (to basement) to study cross-rift asymmetries between conjugate non-volcanic margins along theNewfoundland-Iberian transect.



ANNOUN

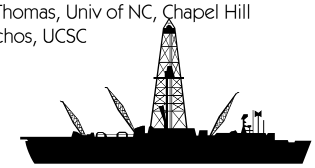
JOI/USSSP Supported Shipboard Participants

Leg 195: Mariana/West Pacific ION Site
TAMU Staff Scientist: Carl Richter
Stephen Komor, Syracuse Univ
Michael Mottl, Univ of Hawaii, Manoa
Craig Moyer, Western Washington Univ
Patricia Fryer, Univ of Hawaii, Manoa
John Lockwood, Consultant
Ivan Savov, USF, Tampa
David Hart, Univ of Wisconsin-Madison
K. Michelle Edwards, RSMAS
Student Trainee: Stan Hammon, Univ of TX, Dallas

Leg 196: Nankai II
US Co-Chief: Keir Becker, RSMAS
US Co-Chief: J. Casey Moore, UCSC
TAMU Staff Scientist: Adam Klaus
LDEO Logging Staff Scientist: David Goldberg
Gary Austin, Scripps
Peter Flemings, Pennsylvania State Univ
Nathan Bangs, Univ of Texas, Austin
Sean Gulick, Univ of Texas, Austin
Denise Hills, Univ of Hawaii, Manoa
Harold Tobin, NM Inst of Mining and Tech

Leg 197: N. Pacific Hotspots
US Co-Chief: Robert Duncan
US Co-Chief: John A. Tarduno
Contract Staff Scientist: David Scholl
Shichun Huang, MIT
Rory Cottrell, Univ of Rochester
William Siesser, Vanderbilt Univ
Frederick Frey, MIT
Randall Keller, Oregon State Univ
Clive Neal, Univ of Notre Dame
Thorvaldur Thordarson, Univ of Hawaii, Manoa
Student Trainee: Jill Gudding, Michigan State Univ

Leg 198: Shatsky Rise
US Co-Chief: Tim Bralower, Univ of NC, Chapel Hill
TAMU Staff Scientist: Mitchell Malone
LDEO Logging Staff Scientist:Trevor Williams
Kristen Averyt, Stanford Univ
Simon Brassell, Indiana Univ, Bloomington
James Channell, Univ of Florida
William Sager, Texas A&M Univ
Mark Leckie, Univ of Massachusetts, Amherst
Jason Eleson, Univ of NC, Chapel Hill
Jennifer McGuire, Texas A&M Univ
Michael Arthur, Pennsylvania State Univ
Deborah Thomas, Univ of NC, Chapel Hill
James Zachos, UCSC



Ocean Drilling Program Town Meeting

Where: **San Francisco Moscone Center, Room 132**
When: **Tuesday, December 11, 5:30-7:30 pm**

Come hear the latest news about ODP and its successor, the Integrated Ocean Drilling Program (IODP), slated to begin on October 1, 2003. In conjunction with the December AGU Meeting in San Francisco, JOI/USSSP is sponsoring an ODP Town Meeting. Scientific community leaders will provide brief updates on the ODP and IODP. This is an opportunity to ask questions and voice your opinions. All are welcome. Refreshments will be served.

Also be sure to stop by the **ODP/IODP Booths (625, 627, and 629).**

Ocean Geoscience Lectures

The JOI/USSAC Distinguished Lecturer Series brings the results of ODP research to students at the undergraduate and graduate levels and to the earth science community in general. JOI will soon begin accepting applications from US colleges, universities, and nonprofit organizations to host talks given by the speakers listed below in the upcoming the 2002-03 season. Applications are available online at www.joiscience.org/USSSP/DLS/DLS.htm or from JOI (phone: 202-232-3900, email: info@joiscience.org). Application deadline: **April 5, 2002**.

The Subduction Squeegee
Barbara A. Bekins, United States Geological Survey

Extreme Climates and Frozen Methane: The Global Carbon Cycle with Gas Hydrate
Jerry Dickens, Rice University

Windows on Subduction Zone Processes
Patricia Fryer, University of Hawaii

The Icy Poles or the Muggy Equator: What Drives Natural Climate Change?
Alan Mix, Oregon State University

The Ups and Downs of Determining Ancient Sea Level Change
Gregory Mountain, Lamont-Doherty Earth Observtory

Life in Marine Sediments: Probing the Limits of Earth's Deep Biosphere
David C. Smith, University of Rhode Island

CEMENTS

Schlanger Ocean Drilling Fellowship

At its July 2001 meeting, USSAC considered 20 shipboard and shorebased fellowship proposals. Four one-year awards were made, as follows:

Benjamin Cramer, Rutgers, The State Univ of NJ
"Evolution of a warm climate: Long-term paleoceanographic trends and short-term orbital forcing of climate in the late Paleocene-early Eocene"
(ODP/DSDP legs 22, 113, 143, 171B)

Maria Prokopenko, Univ of Southern California
"Fractionation of nitrogen isotopes during early diagenesis in the sediments of Peru Margin"
(ODP Leg 201)

Cara Santelli, MIT/WHOI Joint Program
"The role of microorganisms in alteration of basaltic glass in deep oceanic subsurface environments"
(ODP Leg 205)

Matthew Schmidt, Univ of California, Davis
"Temperature and hydrological changes in the Western Caribbean and the Tropical Pacific during the last 750 kyr"
(ODP legs 138 and 165)

Next fellowship deadlines:
April 15, 2002
November 15, 2002

For information: www.joiscience.org/USSSP/

Educational Resources

Email info@joiscience.org to receive free educational materials:

- *Gateways to Glaciation* D-ROM
- *From Mountains to Monsoons* CD-ROM
- *Blast From the Past* Poster

NSF and JOI/USSSP Sponsored Workshop

Cretaceous Climate and Ocean Dynamics

The Nature Place, Florissant, Colorado
July 13-17, 2002

Organizing Committee:
Tim Bralower, University of North Carolina
Karen Bice, Woods Hole Oceanographic Inst.
Bob Duncan, Oregon State University
Brian Huber, Smithsonian Institution
Mark Leckie, University Massachusetts
Brad Sageman, Northwestern University

Including a one day field trip to the Cenomanian-Turonian Boundary at Rock Canyon

To apply send a brief letter of interest by January 31, 2002, to:
Tim Bralower, Depart of Geological Sciences, University of North Carolina, Chapel Hill, NC 27599-3315 (email: bralower@email.unc.edu)

Limited travel funds available to early applicants

This new brochure is based on, *Understanding Our Planet through Ocean Drilling: A Report from the United States Science Advisory Committee*. The full report presents the rationale for why the United States should participate in the international Integrated Ocean Drilling Program (IODP). The brochure is intended to convey this same message in an "at-a-glance" format. The vision for IODP is described fully in *Earth, Oceans and Life* the IODP Initial Science Plan for 2003-2013.

All three documents are available electronically on the JOI/USSSP website (www.joiscience.org/USSSP/) and in hard copy from JOI (info@joiscience.org).

MAGNETIC ARTIFACTS IN APC CORES

contributed by Mike Fuller

My interest in magnetic coring artifacts in ODP sediments arose during Leg 157, my first leg with the ODP. During the cruise we repeatedly found that the horizontal component of magnetization of Advanced Piston Corer (APC) cores was toward the double line on the core liner (X-direction, Figure 1). With every reason to think that the orientation of this fiducial marker on the core liner is random with respect to the geomagnetic field, it was clear that something was awry and the resulting "0" declination an artifact. This particular artifact is one of several, and it was first described by David Schneider and Jean-Pierre Valet on Leg 154 (Curry et al., 1995).

The most universal paleomagnetic artifact is a soft, near-vertical magnetization overprint, which is easily removed by alternating field demagnetization of a few mT (Butler,1992; Opdyke and Channell, 1996). The source of this artifact was tied to the bit in the bottom hole assembly (BHA) by Robin Weeks and Makato Okada on Leg 145, when they noticed that a bit change was accompanied by a change in the soft moment from up to down (or from reversed to normal). On Leg 115, David Schneider and Didier Vandamme attributed a harder magnetic contamination, which survived 5 mT demagnetization, to the field of the APC barrels because the anomalies in alternate cores correlated. This was to be expected with the use of two-barrel assemblies: while one core is being recovered on deck, a second APC assembly is returning to the sea floor for the next core. Numerous other possible magnetic artifacts have been described (e.g., Stokking et al., 1993). For example, near vertical hard magnetization was found associated with deformation in the sediments caused by flow (Roberts et al.,1996). Others suggested that remagnetization could take place immediately after core splitting, possibly as the core recovers from the disturbance in a partially thixotropic state, or as it dries out (e.g., Ali et al., 2000). In addition, deformation during sub-sampling produced additional errors and still others observed the partial disappearance of remanence between the onboard measurements and later onshore measurements following chemical changes (Richter et al., 1999; Yamazaki et al., 2000).

Two obvious factors were likely involved in the artifacts that caught my attention on Leg 157. First, the process of piston coring deforms the sediment, generally in the form of down-turning at the periphery of the core caused by friction between the sediment and the downward-moving piston corer. Second, the magnetic fields associated with the various devices used in coring might give the recovered sediment a soft Isothermal Remanent Magnetization (IRM) as it passes through these fields. More serious still, if the sediment is disturbed, or even allowed to dry out in such fields, a harder magnetization may be generated, which is difficult to separate from the paleomagnetic signal.

EXPERIMENTAL WORK

After expressing my concerns and interests to ODP/TAMU and JOI, I began magnetic field measurements on the *JOIDES Resolution* at port call and on the Leg 166B transit. It is a matter of some amusement to the ship's crews that on many a leg, after a site or two, puzzled paleomagnetists are to be seen with magnetometers measuring the fields of barrels and the like. We found, as others had before, that there were indeed significant fields associated with the pipe, barrels, the cutting shoe and the bit in the bottom hole assembly. Perhaps most disturbing was the sight of rust and other magnetic particles attracted to the actual cutting surface of the cutting shoe.

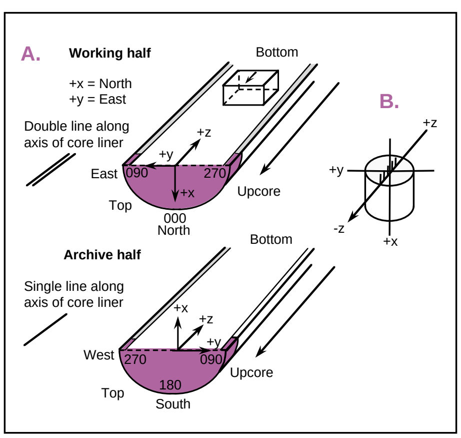


Fig. 1: ODP magnetic orientation convention.

Later, I applied to sail on Leg 174B and requested funds from JOI/USSSP to fabricate two non-magnetic core barels for a series of experiments. My first experiment was to trip a washcore to see what magnetization it would pick up during its passage down the pipe, through the BHA, into the hole and back to the surface. The APC assembly included two non-magnetic barrels with a standard barrel above giving a strong field at the join at the base of the standard core barrel. As expected, the soft magnetization acquired was easily demagnetized. The field at the join was recorded as a soft moment, not as hard magnetization.

During Leg 174B, an opportunity arose for some brief experimental coring, and I used the same APC assembly. This time the strong field at the base of the standard barrel was recorded with a stable magnetization that survived AF demagnetization to 30 mT, suggesting that it may be possible to record anomalous fields from APC barrels as the corer comes to rest in the sediment. It is not clear whether or not this explains the observations of Schneider and Vandamme.

Though good paleomagnetic records are notoriously difficult to achieve from carbonates, an apparently masochistic streak prompted me to sail on three high-carbonate legs, namely Legs 182,189, and 194 to study the artifacts associated with carbonates. A second site augmentation award from JOI/USSSP provided funds to complete an entirely non-magnetic APC assembly. Therefore, it was possible to make comparisons between coring with non-magnetic APC assemblies and with their standard equivalents. The first experiment with the non-magnetic cutting shoe showed a spectacular improvement. Subsequent tests provided similar results, but a number of disturbing features emerged. The improvement was not consistent, and sometimes cores obtained with the standard assembly gave good results. Comparisons between non-magnetic APC and standard barrels showed little difference. Clear evidence of the effect of the bit in the BHA during APC coring was seen in the form of core top anomalies—including hard magnetization—which were much larger with the standard bit than with a less magnetic Russian bit.

Shipboard measurements are made with a 2G Superconducting magnetometer, which gives the three components of magnetization of long cores as they are stepped through the pick-up coils. By measuring empty liners on Leg 189, we found that the noise is principally in the form of hotspots no more than a few cm long that can sometimes be recognized as spikes in records from very weak sediments.

Possible artifacts associated with the lack of symmetry in the measurement of off-center half cores were investigated by Jeff Gee, who showed with elegant experimentation that this was not a serious problem. Drift and poor drift correction can certainly introduce artifacts, including the "0" declination effect. However, Yannick Touchard, Charles Endris and I found on Leg 189 that they are very small. Although a potentially serious effect occurs if resets in the magnetometer electronics are missed during a section measurement, the instrument will not introduce artifacts when used carefully.

Therefore, the key experiments appeared to be those related to core splitting and other treatment in the core laboratory. Here I must digress. During Leg 172, Makato Okada and Gary Acton made critical progress in understanding the artifact introduced into half-core measurements by deformation at the core margin. Subsequently, Okada developed a powerful method to correct for these inclinations (Keigwin et al., 1998). Modeling the rotation of the grains carrying remanence at the margin of the core, he was able to predict the effect on the measured remanence of half cores. His analysis, which used the radial component of magnetization only for the correction, has been extended by Acton and others (2001) to include the vertical component. In principle, this work has solved the problem of the partial rotation of the remanence vector measured in half cores when they suffer this type of deformation at the margin.

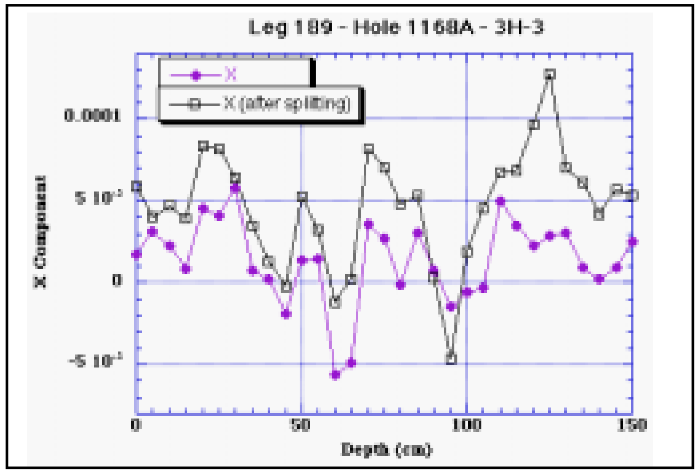


Fig. 2: Comparison of X-component magnetization showing an increase in the +X component after splitting the core but before separating the archive and working halves. The solid circles indicate the measurements taken before splitting, but after 20mT demagnetization to get rid of soft overprint in the washcore. The open boxes are measurements that were made after splitting but before the core is separated.

To continue our experiments, we observed both the mechanical process of cutting the core and the geometric Okada-Acton effect (Figure 2). It is evident that the actual splitting has its own separate effect, in this case a shallowing of inclination, due largely to an increase in the X-component. The inclination, however, continues to shallow as a result of the Okada-Acton effect. The experiment was repeated on weak sediments with similar results, but requires further trials to address the difficulties inherent in more strongly magnetized drift deposits. However, the experiment suggests that in the actual splitting, or immediately after, a moment is acquired. This moment is not a radial moment, but rather is dominantly in the X-direction, or toward the fiducial line. This may be consistent with the suggestion of Jason Ali, Dennis Kent and Ernie Hailwood that magnetization may be picked up in the direction of the ambient field during core splitting and drying out. To test this, additional experiments are underway.

Recommendations

Though this effort remains a work in progress, it is clear that there is a harder moment, in addition to the well-known soft moment, related to the bit in the BHA. This may be partly due to magnetic particles falling down the drill pipe because we found an increase in susceptibility accompanied the core top anomaly, as suggested by Stokking and others (1993). Evidently, the field of the bit is strong enough to affect the magnetization of the core top. This effect is most significant in weakly magnetized sediments such as carbonates, therefore, use of the least magnetic functional bits is recommended, as is the reduction of magnetic contamination from the drill string.

The use of non-magnetic cutting shoes should also be considered. Seeing magnetic particles stuck to the cutting surface of the standard shoes is not encouraging. It is less clear that non-magnetic barrels offer any major improvement. Another possible improvement would be cutting shoes that reduce drag as they enter the sediment, although preliminary tests with one particular slimnose cutting shoe did not show a significant effect. Apparently, the actual drill string pipe does not pose much of a problem, although the external fields associated with it can be very large. The core is in effect inside a magnetic shield and as is evident from readings from the tensor tool, the fields inside are not large.

It is clear that the whole-round measurements are superior to the half core, in that the direct effects of splitting and the Okada-Acton effect are both eliminated. However, there are at least two drawbacks. First, both archive and working half are demagnetized. Second, the additional mass appears to affect the performance of the 2G instrument and, particularly

continued on page 16

CONTINUED FROM PAGE 15

in rough seas, excessive resets necessitate frequent repeat measurements. If it is not possible to make the whole core measurement, a sensible precaution in any attempt to interpret detailed field history is to measure both working and archive halves.

In view of the possible acquisition of magnetization in the core laboratory, some thought should also be given to making a magnetically shielded region in which the cores are handled and measured.

Though these results and those of my colleagues explain some observed artifacts, including examples of "0" dedlination, they do not explain why some sediments give excellent results and others give poor results. Likely key factors are the intensity of magnetization, the shear strength of the sediment, and the grain size of the magnetic carriers.

Acknowledgements

With great pleasure I acknowledge all my help on the *Resolution*. Bernhardt Herr, Margaret Hastedt, Roberto Garza-Molina, Charlie Endris, Edwin Garrett, Yannick Touchard, Tesfaye Birke and Mads Radsted assisted with the additional measurements I proposed. Help from the operation managers, in particular Ron Grout; the drilling engineers; and those on the rig floor was essential to this work. Finally, thanks to Carl Richter, Gary Acton, Matt O'Reagan and Dave Schneider for their reviews of this article.

The Author

Dr. Michael Fuller is Professor Emeritus at the Univ. of California, Santa Barbara, and a Senior Researcher at HIGP-SOEST, Univ. of Hawai'i.

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Call for Proposals!

A new international scientific ocean drilling program will begin in October of 2003. The interim Science Advisory Structure (iSAS) of the Integrated Ocean Drilling Program (IODP) is now accepting drilling proposals that make use of the multiple drilling platforms that will be available in this new program.

Proposals to IODP should address the scientific themes described in the IODP Initial Science Plan (now available at www.iodp.org). The proponents should indicate how the proposed ocean drilling will significantly advance our scientific understanding of Earth processes that are addressed under these broad themes.

The IODP Initial Science Plan calls for the following types of platforms to be available to proponents:

- A non-riser, dynamically positioned drillship similar to the *JOIDES Resolution*, but with enhanced laboratory facilities, capable of drilling in nearly all oceanic water depths.

- A state-of-the-art, dynamically positioned drillship with riser well control. Initially this ship will be limited to water depths between about 500-2500 m. Drill string length will be approximately 10 km. On-board laboratory facilities will be comparable to those on the non-riser ship (see pages 74-77 of the Initial Science Plan).

- "Mission-specific platforms" to address scientific problems that cannot be drilled using the two primary drilling platforms. Such missions might include drilling in very shallow waters or in ice-covered areas. Laboratory facilities for these platforms will be considered on a case-by-case basis.

Until the official start of IODP, an interim Science Advisory Structure (iSAS) will accept and evaluate all drilling proposals. For the latest guidelines on preparing and submitting drilling proposals during the interim period, please visit the iSAS web site (www.isas-office.jp) or contact the iSAS Office directly at Japan Marine Science and Technology Center, 2-15 Natsushima-cho, Yokosuka 237-0061, Japan. E-mail: isasoffice@jamstec.go.jp

Deadlines for electronically submitted proposals: 1 April and 1 October.

IODP: Anchors Away

IODP Planning Progresses

The International Working Group (IWG) is responsible for planning the Integrated Ocean Drilling Program (IODP) and continues to make steady progress as reported on page 22, herein. For details on program principles and structure, see the executive summaries of the IWG meeting minutes at www.iodp.org/iwg.

IODP Initial Science Plan

The Initial Science Plan (ISP) for IODP, titled "Earth, Oceans, and Life: Scientific Investigation of the Earth System" has been printed. The scientific goals for IODP are defined in this 110-page document, including understanding the nature of earthquake-generating zones, complex microbial ecosystems in the Earth's subseafloor, and gas hydrates. To receive a paper copy, please contact the IWG Support Office at iwgso@joiscience.org. You may also download a copy at www.iodp.org.

iSAS Office Opens

The interim Science Advisory Structure (iSAS) Office was established in Japan in June 2001 and will operate until IODP is officially established on October 1, 2003. The purpose of the office is to promote a smooth transition from ODP to IODP and to provide administrative support for the iSAS panels and committees. The iSAS website is: www.isas-office.jp.

All Aboard!

A preliminary proposal, "Canada in the IODP," submitted by the Atlantic Canada Petroleum Institute and a team of ODP scientists to the Canada Foundation for Innovation (CFI), has been well received. A full proposal to CFI is the next step. The successful pre-proposal can be viewed at: www.dal.ca/CanadaODP.

The European Steering Committee on Ocean Drilling (ESCOD) and the Joint European Ocean Drilling Initiative (JEODI) are aiming to bring a distinctive European component—that of "mission-specific platforms"— to IODP. Both groups along with the European Science Foundation sponsored the "Alternate Platforms as part of IODP Conference" (APLACON) which was held Lisbon, Portugal in May 2001. APLACON's purpose was to provide follow-up planning activity to previous planning conferences: CONCORD (riser drilling) and COMPLEX (non-riser drilling). JEODI intends to develop a management structure for Europe as part of IODP, in which the consortium will aim for 1/3 membership in the program to obtain maximum European participation. For more information about JEODI and other European IODP planning activities, visit the JEODI website at: www.jeodi.org.

Fig. 1: The Japanese riser drill ship, *Chikyu*, is currently under construction at Mitsui Engineering & Shipbuilding Co. Ltd. shipyard in Okayama, Japan. This photo, courtesy of JAMSTEC, shows its progress as of October 9, 2001. Vessel specifications are:
Length: 210 m
Breadth: 38 m
Depth: 16.2 m
Gross Tonnage: 57500 t
Derrick height: 110 m (above draft)
Max. Complement: 150 persons

Riser Drillship Named

Following a nationwide contest, overseen by Nori Nasu, which resulted in nearly 10,000 entries, the Japanese riser drillship has been named *Chikyu,* which means "Earth" in Japanese. During the contest, from March 1 to May 15, 2001, a model of the 210-meter ship toured eight scientific museums throughout Japan. A commencement ceremony was held on April 25 in Okayama for the construction of *Chikyu* (Figure 1). In January, the hull will be launched and transported from Okayama to Shimonoseki to be outfitted with laboratory stacks (Figure 2). Sea trials for the *Chikyu* will begin in 2003 before international operation of the ship commences in 2006.

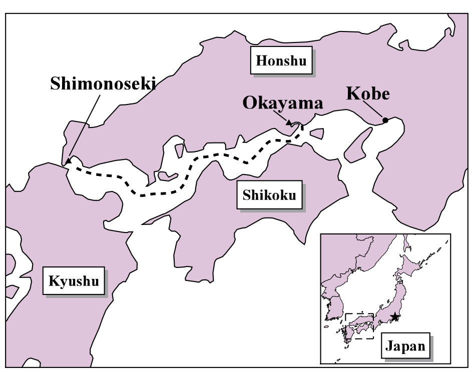

Fig. 2: On January 18, 2002, the *Chikyu* will be launched from Okayama, Japan and transported to Shimonoseki where it will be outfitted.

IWGSO Open until Oct 2003

The U.S. National Science Foundation and the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) have extended the duration of the IWG Support Office (IWGSO) for a second two-year term. The IWGSO will continue to support the IWG, its planning groups, and coordination among Japan, the US, and other potential partners of IODP until October 1, 2003.

New Faces at the IWGSO

In June, IWGSO said "doumo arigatou" and "sayonara" to Masanori (Max) Shinano, the JAMSTEC Management representative. He now works in the Promotion Policy Division of the Research Promotion Bureau at Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT). IWGSO welcomes Izumi Sakamoto, who joined the office in August to fill the position. In July, Jennifer Peterson departed IWGSO for California and Betsy Fish was named to succeed her as the IWG Support Office Coordinator.

INFLUENCES ON BORON CONCENTRATION AND ISOTOPIC COMPOSITION OF PLANKTONIC FORAMINIFERA

Michael Wara
Ph.D. Institution:
University Of California, Santa Cruz

Faculty Advisors:
Ana Christina Ravelo
Peggy Delaney

One of the most promising avenues open towards reconstructing the ocean carbon cycle at times in the geologic past is the boron isotope paleo-pH proxy in foraminiferal calcite. My fellowship research with Christina Ravelo and Peggy Delaney at U.C. Santa Cruz and with Tom Bullen at the U.S. Geological Survey had two primary goals: 1) to develop a more complete understanding of the behavior of this proxy in marine sediments, and then 2) to construct a Plio-Pliestocene record of mixed layer pH to compare to the global climate deterioration during this interval.

Inorganic boron in seawater occurs in two forms, boric acid ($B(OH)_3$) and borate ($B(OH)_4^-$), the relative abundance of which is determined by pH (pK^*_B = 8.812) (Dickson, 1990). In addition, the isotopic composition of each species is also a function of pH because of fractionation during the dissociation reaction. Foraminifera incorporate only the tetrahedral form in their calcite tests. Thus the concentration and isotopic composition of boron in foraminiferal calcite is determined by the concentration and isotopic composition of seawater borate which is in turn determined by seawater pH (Sanyal et al., 1996). All this assumes that uptake of boron by foraminifera is not also affected by any other processes. Our work aims to test this assumption.

We measured boron/calcium (B/Ca) and magnesium/calcium (Mg/Ca) ratios, boron isotopic composition ($\delta^{11}B$), and the average shell mass of planktonic foraminifera at Ocean Drilling Program Site 806 on the Ontong-Java Plateau in the Western Equatorial Pacific. Our records extend from 5 Ma to present with a 0.33 Myr resolution. Our results strongly suggest two heretofore unobserved influences on the $\delta^{11}B$ of planktonic foraminifera.

First, B/Ca and $\delta^{11}B$ are linearly correlated with Mg/Ca in our samples (Figure 1). This suggests that, like magnesium and cadmium, boron uptake by foraminifera is strongly temperature mediated. Second, we observed a significant correlation between average shell mass and our boron measurements (Figure 1). This suggests either that partial dissolution or alternatively post-depositional addition of calcite is also affecting B/Ca and $\delta^{11}B$ in our samples.

Our data are the first from marine sediments to combine boron isotope measurements with boron concentration data and with other proxy measurements. It demonstrates that the interpretation of B isotope measurements of planktonic foraminifera is significantly more complex than has been previously appreciated. We argue that without controlling for temperature and preservation effects, boron based paleo-pH estimates are likely to be in error. In addition, incorporating corrections for these additional factors will necessarily lead to a larger uncertainty for paleo-pH estimates.

Recent studies using B isotopes call for a significant revision of current thinking about the Cenozoic history of atmospheric pCO_2 (Pearson and Palmer, 2000). We maintain that until temperature and preservation effects are controlled for, these data should be interpreted with caution. Our ongoing work aims to better understand the effects of temperature on benthic, as well as planktonic, foraminifera.

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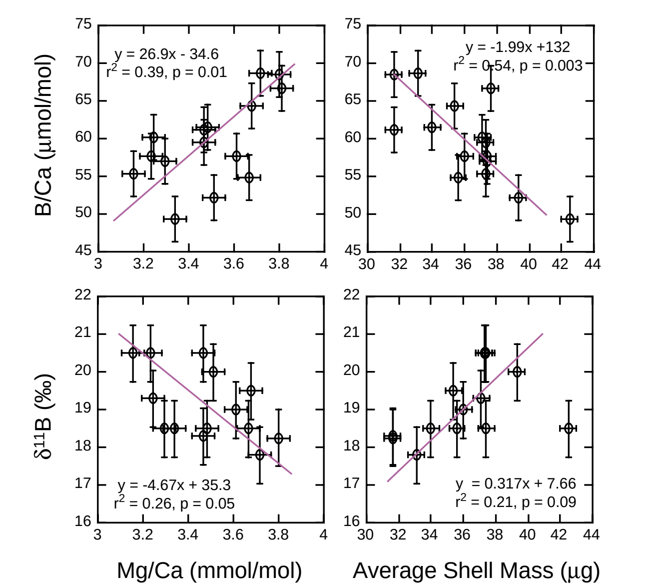

Fig. 1: B/Ca ratios and δ11B of our samples compared with Mg/Ca and average shell mass. Mg/Ca ratios are a function of calcification temperature while average shell mass is an indicator of shell preservation state. Also shown are geometric mean regressions to the data, correlation coefficients, and the probablity, p, that a correlation might occur by chance.

PHOSPHORUS AND METAL BIOGEOCHEMISTY OF THE SOUTHERN OCEAN

Jennifer Latimer

Ph.D. Institution:
Indiana/Purdue University, Indianapolis

Faculty Advisor:
Gabriel Filippelli

The Schlanger Ocean Drilling Fellowship funded my investigation of phosphorus (P) burial and terrigenous sedimentation records in the southeastern Atlantic Ocean using cores recovered during Leg 177. In particular, I am investigating how changes in climate (glacial/interglacial differences) and changes in ocean circulation (the opening of the Drake Passage and/or the establishment of the Antarctic Circumpolar Current and frontal systems) have influenced these records. While many studies have assessed paleoproductivity and nutrient content of the Southern Ocean, few have investigated records of P burial.

In these glacial/interglacial investigations, I am studying one sub-Antarctic site (1089), two sites in the polar front zone (1091 and 1092), and two sites south of the modern day Antarctic Polar Front (1093 and 1094). I am using P records, including reactive P concentrations, total P accumulation rates, and P/metal ratios (P/Al and P/Ti) as a proxy for export production. I am also using the accumulation of terrigenous elements like Al and Ti as proxies for the terrigenous or detrital component. The goal of this transect study is to assess changes in P burial, productivity, and terrigenous inputs across the frontal zones in the south Atlantic over the past 1 Myr. Initial results suggest higher terrigenous inputs and increased export production, based on P geochemistry, during glacial intervals.

A middle Eocene to early Miocene record was recovered at site 1090. This site provides an excellent opportunity to compare productivity records from a northern sub-Antarctic site (Latimer and Filippelli, in press) to productivity records from Antarctic sites on Maud Rise and Kerguelen Plateau. Based on P/Ti, P/Al, and Ba/Al ratios (Fig. 1B, C), during the middle Eocene (Diester-Haass, 1995) and across the Eocene/Oligocene transition (Salamy and Zachos, 1999), we see evidence for increasing export production similar to that identified at more southerly sites.

The opening of the Tasmanian Seaway and the Drake Passage led to changes in the Southern Ocean during the Eocene through Miocene epochs. Recent drilling in the area has constrained the opening of the Tasmanian Seaway to near the Eocene-Oligocene boundary (Shipboard Scientific Party, 2000). However, the opening of the Drake Passage remains somewhat equivocal. Sediment geochemical records from Site 1090 provide evidence for the timing of the opening of the Drake Passage in the earliest Oligocene. Al/Ti records (Fig. 1A) indicate a change in source from continental terrigenous material to oceanic detrital material across the Eocene/Oligocene transition. In addition, Ba concentrations (Fig. 1d) undergo a permanent change across the Eocene/Oligocene transition, from low values during the Eocene to higher and more variable values beginning in the earliest Oligocene. We suggest that this switch from continental to oceanic metal sources and the permanent change in the Ba record indicate a major change in ocean circulation related to the opening of the Drake Passage.

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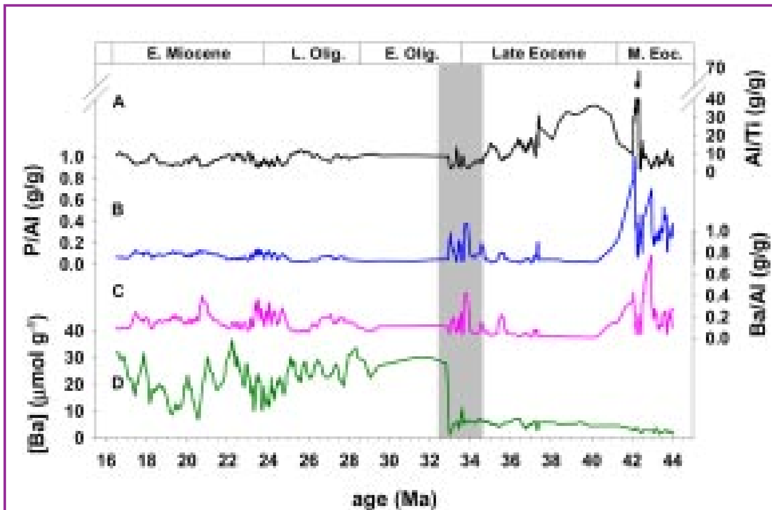
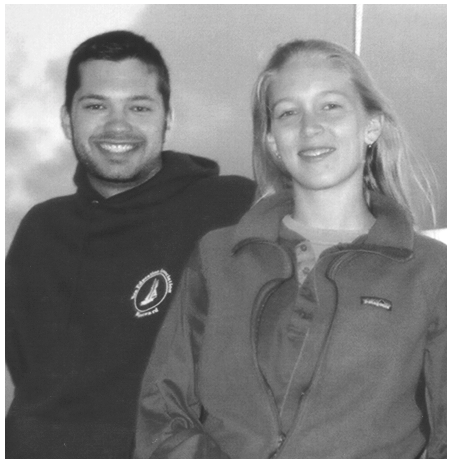


Fig. 1: Seven point smoothed elemental ratios and total Ba concentrations at Site 1090. The gray bar represents the Eocene-Oligocene transition.

LIFE AS A DC INTERN

contributed by Micah Nicolo and Christina Riesselman

Last December, I learned of the USSSP internship opportunity at Joint Oceanographic Institutions (JOI) through my undergraduate honors advisor, Leah Joseph, at Hobart College. Having no idea what I wanted to do after graduation, other than not go directly to graduate school, I decided to apply for the internship, and thankfully, I was accepted. I graduated with an Honors BS in Geoscience, a BA in Political Science, and a minor in Environmental Studies, and then left the comfortable upstate New York life for Washington, DC, to explore a different sort of meaning to the infamous words: "DC intern."



Micah and Christina aboard the CCGS *Hudson* in August 2001.

The first several months of my internship have been consistently rewarding with work suited to many of my interests. While general office assistance has certainly been an aspect of my internship, I have also had time to focus on several of my own projects. As the year 2003 approaches, I have been asked to look not only towards the future, but also to reflect upon ODP's past and particularly how it, coupled with the US Science Support Program, has benefited the United States scientific and academic community. My role in this has been to compile data from the past 17 years and generate maps for publication that illustrate the breadth of institutions represented by USSSP funded shipboard participants, Distinguished Lecturer recipients, and JOI/USSSP Fellows. Currently, I'm working on a series of downloadable ODP power point presentations aimed at providing speakers with a lecture aid on such topics as the deep biosphere, sea floor seeps, gas hydrates, rapid climate change, shipboard activities, and an ODP program overview. These presentations will be available soon from the USSSP website (www.joiscience.org/USSSP).

In addition to my time in DC, this internship has also offered me a few opportunities to step out of the office. A particularly memorable experience was sailing with scientists from the Bedford Institute of Oceanography on a week long geophysical and piston core sampling cruise out of Halifax, Nova Scotia on board the *Hudson*, a Canadian Coast Guard vessel. Also, at Fall GSA this year, I represented both USSSP and Hobart College in a short talk about my undergraduate research titled: "Environmental System Transition at the Mid-Holocene Hypsithermal: Evidence from the Sediment of Seneca Lake, NY."

I plan to go to graduate school in the coming year and so have started the process of looking for the right school, as well as the right advisor. However, I have enjoyed my time with JOI immensely, and I would like to take this opportunity to thank everyone who has been a part of it.

I grew up in western Montana, where geology defines the horizon, marine life is fixed in the Madison Limestone, and the 49th parallel is affectionately dubbed "the Northern Seaboard." During my childhood, the sea was large, blue, and far-away. Later, as a geology student at the University of Nebraska-Lincoln, my understanding of oceans evolved. I had recognized their impact on the modern earth; they now became a depositional environment in my stratigraphy class; a habitat for organisms from plesiosaurs to diatoms; the modern analog through which ancient processes could be filtered and understood.

Last May, I graduated from UN-L with a BA in English and Geology and an Italian minor. As the final months of my university career careened past it was unsettling to realize that, five years and a double major into my higher education, I was still unsure of what I wanted to be when I grew up. When my undergraduate and honors thesis adviser, David Watkins, learned that JOI was looking for interns, he pulled me aside. Handing me a small stack of publications with the "JOI Fishes for Intern" Drill Bit at the top, he said, "I know you don't know what you're going to pursue in grad school, and I think this is a good place for you to figure it out."

Several months into the internship, my concept of ocean science has matured. I have helped edit a number of JOI publications, including USSSP workshop reports and this newsletter, and have scoured our collection of existing film footage, cataloging clips and interviews, to prepare for future educational and outreach videos. I have also been fortunate to work with folks outside the office, developing a press realease for Leg 198 and sailing with scientists from the Bedford Institute of Oceanography on a brief research cruise to the Scotian Slope.

Currently, I'm converting lecture materials from the 2000-2001 JOI/USSAC Distinguished Lecturer Series into power point presentations for the USSSP web site, so that the best of ODP science can be made available to a broad range of institutions. Working on this project, I have come to appreciate the enormity of the contributions the ODP has made to the geological community, as well as the volume of discovery still waiting beneath the ocean floor. I have also recognized, as a participant in this scientific community, that I definitely wish to pursue post-graduate study in geosciences, and have begun my search for programs that match my interests. And I have finally mastered the DC Metrobus system.

THE ONLY CONSTANT IS CHANGE...

These are exciting, rewarding, and challenging times for scientific ocean drilling. We are sailing into the final years of the Ocean Drilling Program (ODP) and are less than two years away from the scheduled start of its successor, the Integrated Ocean Drilling Program (IODP). In this column, I want to give you key information about current activities in ODP and IODP. Times of change require us to be aware of and examine our assumptions, practices, and structures.

ODP continues full steam ahead, with the schedule for the *JOIDES Resolution* complete through the end of ODP operations. Leg 210 to the Newfoundland Margin is the final leg, followed by a brief transit and ship demobilization in September 2003. Many opportunities to participate remain in ODP, and I urge you to take advantage of them. A variety of shipboard scientific specialties are needed for every leg, and no previous seagoing experience is required. Remember, shipboard staffing begins 6-9 months precruise, and the application process can be completed at the ODP web site (www.oceandrilling.org).

IODP is an international scientific venture addressing global Earth system problems, enhancing progress in a broad range of programs in basic and applied research, information technology, and science education. IODP's exploration will rely on multiple drilling platforms with global access, including a non-riser drill ship to be provided by the United States, a riser drill ship now under construction in Japan, and mission-specific platforms. The scientific and organizational framework for IODP's first decade, beginning October 1, 2003, is described in its Initial Science Plan (ISP), *Earth, Oceans and Life: Scientific Investigation of the Earth System Using Multiple Drilling Platforms and New Technology*. This document is now published (see www.iodp.org or request a copy from JOI). If you don't have a copy, I recommend you get one! USSAC has prepared two "companion" documents to the ISP. A brief, glossy brochure titled *United States Participation in the Integrated Ocean Drilling Program, 2003-2013* was recently completed, and we are putting the finishing touches on a more substantive document that inspired the brochure titled *Understanding Our Planet through Ocean Drilling* (with a nearly final version available on the web at www.joiscience.org/USSSP/). The interim Science Advisory Structure for IODP is up and running (www.isas-office.jp) and an IODP update is on page 14 of this newsletter.

USSAC's attention is increasingly focused on formulating recommendations about support of U.S. science in IODP. A review of the current funding sources serves as a basis for these discussions. ODP operates with an annual budget of ~$46.1M, with the U.S. National Science Foundation (NSF) contributing ~64% of that total. These are the funds required to operate the drilling vessel and provide the infrastructure and staffing support for shipboard and shore-based scientific activities. Within the Marine Geosciences Section at NSF, the ODP activities have a $9-10M annual budget. This program supports pre-drilling and drilling-concurrent activities, with a focus on investigations of potential drilling regions.

Through a cooperative agreement with Joint Oceanographic Institutions (JOI), NSF also funds the United States Science Support Program associated with the ODP (JOI/USSSP), with a ~$6.1M annual budget. The USSSP budget includes support for U.S. scientists to participate in drilling expeditions, to research and publish initial scientific results, to participate in workshops and international planning activities related to scientific ocean drilling, to pursue a limited array of educational programs, to develop drilling-related technology, and to characterize the seafloor prior to drilling. The largest component of the USSSP budget is shipboard scientist support, with salary support for shipboard scientists, travel to and from the vessel for these scientists, and competitively awarded, small, post-cruise 'starter' grants collectively accounting for nearly two-thirds of the USSSP annual budget. The majority of scientific research on ODP samples and data is funded through unsolicited proposals to the NSF Geosciences Division, and it is not easy to quantify this support.

In my opinion, we face significant challenges in funding IODP and U.S. participation in it. The estimated annual platform and scientific operating costs for a two-vessel program are $130-140M, with U.S. and Japan committed to equal partnership in IODP. There are promising activities by other potential partners focused on providing mission-specific platforms (for example, the activities in the European community), but many details, including financial ones, remain to be resolved. USSAC is convinced that U.S. scientific achievement in the international IODP will depend on a strong national program, beyond funding platform operations, to support the participation of individual U.S. scientists. Given the multi-platform nature of IODP and the ambitious scientific goals, USSAC's initial discussions point toward a doubling of the funds available in NSF/ODP activities and for support of activities like those currently funded by USSSP. In addition, achieving IODP objectives will require increased funding for NSF unsolicited proposals and a better alignment of U.S. scientific ocean drilling community goals with funding priorities and outcomes. We plan to have concrete recommendations to put forward for community review over the next year, and we welcome your input.

Sincerely,

Margaret L. Delaney
Chair, USSAC

NEWS AND VIEWS FROM NSF

contributed by J. Paul Dauphin, Program Director, NSF/ODP

In August, ODP's Science Committee (SCICOM) scheduled an exciting and robust drilling program for the *JOIDES Resolution*'s final year of operations, which ends September 30, 2003. The track takes the drilling vessel from the eastern Pacific into the North Atlantic and ends in the Gulf of Mexico where it will be demobilized (see page 7). As ODP approaches its last stages, planning within the science community and potential funding entities continues at a vigorous and unrelenting pace to ensure that the follow-on program, the Integrated Ocean Drilling Program (IODP), is seamlessly in place by October 1, 2003.

The IODP International Working Group (IWG), a collection of international funding agency representatives engaged in the formal planning for a post-2003 scientific drilling program, met in Ottawa, Canada this past June. The IWG has met every six months since 1997 and is co-chaired by Dr. Yoichiro Otsuka, Director for the Earth and Oceans Division of Japan's Ministry of Education, Culture, Sports, Science, and Technology (MEXT) and by Dr. Margaret Leinen, Assistant Director for Geosciences at the U.S. National Science Foundation (NSF). MEXT and NSF are defined as the Lead Agencies for IODP and as such will contribute equally to total program cost and will take on additional responsibility as necessary to fully support the program.

The IWG has made significant progress in defining and agreeing to the various elements needed to make the new program a reality. At its last meeting, the IWG agreed on the Management Principle, which calls for a Central Management Office (CMO) that will develop and manage the implementation plans for the IODP science program and will have a formal arrangement with IODP Lead Agencies for this activity. In defining the tasks and responsibilities of the CMO, the IWG agreed that these are to be based on the recommendations of IODP's international Science Advisory Structure (SAS). The IWG attached the following characteristics to the CMO: a) it should be committed to IODP science, b) it should be unbiased, c) it should be independent, and d) it should be a legal entity. The full text of the Management Principle and the definition of the Tasks and Responsibilities of the CMO can be found at IODP's web site: www.iodp.org.

At its June meeting, IWG also discussed a joint European effort to provide IODP with a mission specific platform capability. The proposal envisages Europe participating in IODP as a single entity or consortium—and ideally as a lead agency. The same conditions, which apply to the riser and non-riser platforms, as defined by the Platform Principle would apply to the mission specific platform(s). The European members of IWG were very positive about this approach and requested that IWG consider and comment on a set of principle that defines European participation. A response and discussion will occur at the next IWG meeting in January 2002 in Kobe, Japan.

An interim Science Advisory Structure (iSAS) for IODP is now in operation and functions in a similar manner as the JOIDES advisory structure for ODP. The interim Planning Committee (iPC) of iSAS is equivalent to SCICOM in ODP and is Co-Chaired by Dr. Ted Moore, University of Michigan and Dr. Hajimu (Jim) Kinoshita, JAMSTEC. The iPC has already had its first meeting in August and has recommended the formation of several interim science advisory panels. iPC will shepherd, evaluate and encourage drilling proposals for the platforms to be supported by IODP. October 1 was the first deadline for submission of drilling proposals and the iSAS support office received eleven new proposals. In addition, fifty-nine proposals—several with revisions—were transferred from ODP bringing the total of active iSAS proposals to seventy. More information is available at www.isas-office.jp/.

This is an opportune time to remind you that the NSF/ODP is encouraging the development of mature IODP drilling proposals by supporting regional geological and geophysical studies from U.S. scientists and institutions. In keeping with the thematic emphasis of the IODP Initial Science Plan, the NSF will accept proposals for work in any ocean. However, as the international planning effort focuses drilling plans on a particular region, proposals for work in that region will receive special attention.

On a different note, we warmly welcome Dr. James Yoder as he assumes the Directorship of NSF's Division of Ocean Sciences. He replaces Dr. Michael Purdy who accepted the position of Director at the Lamont Doherty Earth Observatory, Columbia University last November. Dr. Don Heinrichs, who came out of retirement to fill in as the interim Division Director, is now returning to his garden and the good life. With his intimate knowledge of NSF and his devotion to the ocean sciences, another encore by Don won't surprise us.

The Division recently reorganized into three sections and has been looking to fill the position of Head for the Marine Geosciences Section, which encompasses the Marine Geology and Geophysics Program and the Ocean Drilling Program. The selection process is well underway. Don Heinrichs was also temporarily filling this position but with his departure, Bruce Malfait—while continuing with his ODP responsibilities—is serving as acting Head until the selection process is finalized.

Paul is too modest to identify another personnel action. Due to the increasing workload and requirements of IODP planning, as well as ODP phase-down, a second Program Director position was established in NSF/ODP, and Paul has been promoted to fill that position. With the promotion comes an increased responsibility in planning and administering U.S. ODP science support and internal coordination for IODP planning.

THE U.S. SCIENCE ADVISORY COMMITTEE

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JOI/USSAC NEWSLETTER

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HOLE 735B, CONTINUED FROM PAGE 5

measured magnetization is a primary remanent component, which implies that the likely source for induced magnetization at segment ends is serpentinized peridotite. The active (inside corner) and inactive (outside corner) portions of the transform offsets show similar magnetization intensities, despite an inferred difference in crustal structure between the two settings. The absence of a time lag between the magnetic age of the crust at Atlantis Bank and that of the adjacent crust strongly suggests that the lower crust is a significant, if not dominant, source of crustal magnetization in off-axis settings and is responsible for a major part of the reversal pattern in the observed magnetic anomalies.

CRUSTAL STRUCTURE

Marine gravity data converted to mantle Bouguer anomaly (MBA) show a single, large-amplitude low centered approximately midway between the fracture zones. This result, together with morphology, magnetic, and numerical models of mantle thermal structure, suggests that a single region of mantle upwelling supplies melt to the segments. Long periods of relatively robust crustal production ceased during the emplacement of Atlantis Bank and during the migration of the propagating rift. Significant asymmetry is observed in seafloor morphology, MBA, and inferred crustal thickness across the axis of the eastern segment. On the slower-spreading north flank, seafloor is smoother, MBA is lower, and inferred crustal thickness is 25% larger than at the faster-spreading south flank. These asymmetries may derive from excess crustal production on the north flank, excess crustal extension on the south flank, and/or a north-south variation in mantle temperature. Inferred crustal structure on conjugate flanks of the western segment is more uniform than at the adjacent segment. Gravity data tied to seismic results near Hole 735B suggest that the crust is ~1.75 km thick at the site.

FUTURE DRILLING?

Compared to the rest of the study area, the bathymetry and inferred crustal structure at Atlantis Bank (and Hole 735B) are anomalous, but the magnetic structure is similar. To investigate these similarities and differences in more detail, a series of offset holes could be drilled east of Atlantis Bank where an intact upper crust presumably still exists. The utility of such a program has already been demonstrated by Hole 1105A (Leg 179) located 1.2 km east of Hole 735B. Although Hole 1105A extends to just 1/10 the depth of Hole 735B, lithologic units and geophysical characteristics appear to be laterally continuous between the holes, possibly providing a scale over which melt supply and delivery processes are similar.

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