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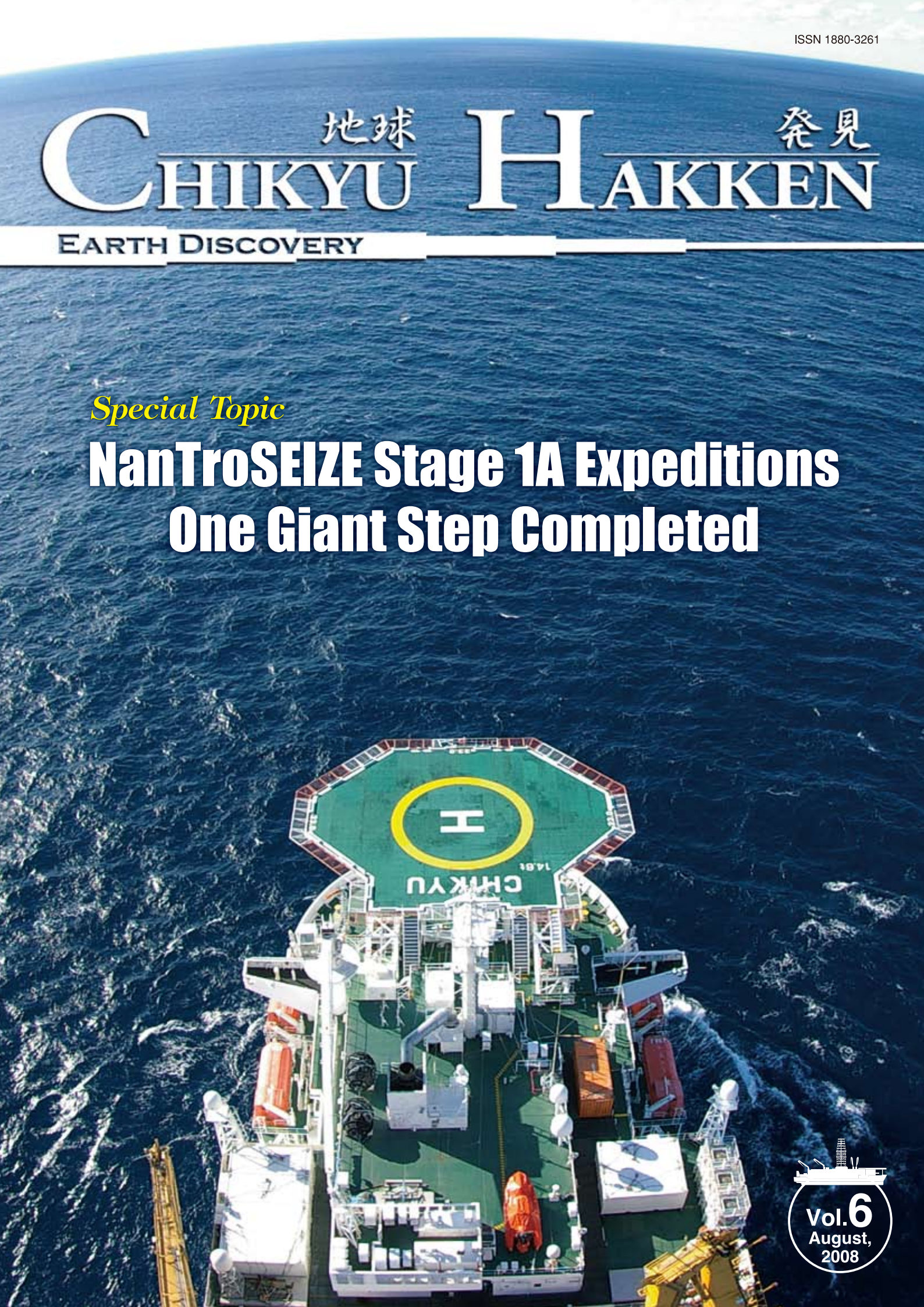
EARTH DISCOVERY

Special Topic

NanTroSEIZE Stage 1A Expeditions One Giant Step Completed



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Special Topic

NanTroSEIZE Stage 1A Expeditions One Giant Step Completed

The world's top scientists participated in the exciting Stage 1A of the "Integrated Ocean Drilling Program: Nankai Trough Seismogenic Zone Experiment Project (NanTroSEIZE)," which will continue for the next several years. NanTroSEIZE targets the Nankai Trough of the Kumano-nada coast off the Kii Peninsula, where large M8-class earthquakes have repeatedly occurred.

More than 60 scientists from 12 countries were aboard the Deep Sea Drilling Vessel *Chikyu* for 138 days (from 21 September 2007 until 5 February 2008) of the Stage 1A Expedition. With great thanks to everyone involved, *Chikyu* acquired a trove of invaluable data while overcoming numerous difficulties.

Discussion members

Expedition 314

Dr. Masataka Kinoshita
Co-Chief Scientist
IFREE/JAMSTEC

Dr. Moe Kyaw Thu
Expedition Project Manager
CDEX/JAMSTEC

Expedition 315

Dr. Juichiro Ashi
Co-Chief Scientist
The University of Tokyo

Dr. Hideki Masago
Expedition Project Manager
CDEX/JAMSTEC

Expedition 316

Dr. Gaku Kimura
Co-Chief Scientist
The University of Tokyo

Dr. Daniel Curewitz
Expedition Project Manager
CDEX/JAMSTEC

Shinichi Kuramoto
IODP Expedition Manager
CDEX/JAMSTEC

The "Earth Discovery" introduces people involved, as well as exciting expedition episodes. Previous spots have highlighted functions and characteristics of *Chikyu* as well as expedition plans, with interviews of leading Co-chief Scientists, Expedition Project Managers and IODP Expedition Managers. First, Co-chief Scientists' comments and overall impressions of the expeditions.

Kinoshita: Each expedition included two Co-chief Scientists. Highly motivated scientists from different countries boarded *Chikyu*, obtaining core samples for understanding the mechanism of earthquakes. I valued teamwork while respecting their thoughts, and maintained high quality research. The best way of consensus building, I found, was that whenever there was any disagreement, we discussed it thoroughly until we reached a solution.

Kimura: I have served as a chief scientist twice. Since people from different cultures and languages work together, it's no wonder if any trouble occurred. But as Dr. Elizabeth Screaton on the successful Expedition 316

The Smoothest Expeditions Ever !

commented, applied efficient takeover procedures and tried to focus on one theme at each meeting, so that we could quickly reach an agreement and build consensus among different scientists.

Comments from EPMs (Expedition Project Manager), on facilitating scientists needs as the Co-Chiefs' right hand

Kinoshita: The EPMs (Drs. Moe, Masago, and Curewitz) successfully maintained a friendly environment for scientists from different countries while concentrating on their research.

Ashi: I was onboard with EPM Dr. Masago. He was really indispensable in coordinating researchers on the vessel.

Masago: My impression was that researchers naturally came to think that, 'If you have questions, ask an EPM!' I appreciated the opportunity to meet many scientists including young postgraduate students.

Chikyu Provided Big Chance

Dr. Harold Tobin
Expedition 314 Co-Chief Scientist
University of Wisconsin (USA)

We scientists have waited for a drilling vessel like *Chikyu* for many years. None existed that could drill 7,000 meters beneath the seabed with the proper facilities and instruments for research. But thanks to Japan for building *Chikyu*, we now have a chance to drill the deep seas and investigate massive seismogenic zones.

The "Giant Floating Lab" enables us to core and analyze almost simultaneously. Excitement peaked with scientists expectantly waiting for fresh cores. Stress also came from long waiting periods. Several episodes are described below.

Kinoshita: Fresh core samples were lined up, and real time data came immediately, driving an exciting progress in science.

Kimura: Any scientist can understand the stress of being unable to get a sample. It is normal that no cores are collected even when due. But the stress levels gradually increase, when you wait it for a day, five days or ten days.

Kuramoto: There were times when we got tired, as we just couldn't collect any samples, no matter how deeply we dug.

Ashi: Half the researchers left *Chikyu* 5 days before coring completion due to a change in the drilling schedule taking current conditions into consideration. It was so unfortunate that they had to leave without samples.

Kimura: Everybody wanted samples, so to find a compromise was very important.

Sharing information among related people is the key to successful expeditions. Consensus building among different interested parties involved steady, daily efforts. Recalled by Dr. Kuramoto as follows:

Kuramoto: Meetings included not only people aboard ship, but from 5 different locations, everyday, discussing the expedition and drilling plans as well as problems to be solved. Management was difficult, since two versions of meeting minutes, both Japanese and English, were made so that consensus could be built, and decisions made, among many related parties.

Aboard ship, Labs operate for 24 hours, but also is home to 150 people at the same time. Some examples:

—— What were your impressions of research and daily life on *Chikyu*?

Group discussion of Stage 1A Expeditions

Moe: Many researchers and lab technicians worked together in the same research section, which enabled us to have fruitful theme-specific discussions. During the short break, we went to the helipad deck to watch the sunset, and some people jogged on the deck.
Curewitz: The most memorable part was the incredible number of people from all over the world, the challenge and excitement of working with people with such different cultural backgrounds. At one point we were trying to recover a core that was stuck in a core barrel, and we needed the help of the machinists, the drill-floor crew, and the lab technicians. People from Philippines, Scotland, Japan, South Africa worked together. It was a great experience.

—— Dr. Masago said *Chikyu* was very comfortable.
Ashi: There was a private shower and toilet in each room, better conditions than other major vessels. You could get refreshed when you returned to your room.
Kinoshita: Good food and laundry services were provided, so we can concentrate on research for 24 hours a day.

Chikyu to Help Solve the Mystery of Planet Earth

Dr. Siegfried Lallemant
Expedition 315 Co-Chief Scientist
Université de Cergy-Pontoise (France)

NanTroSEIZE Stage 1A gave me a great experience. We could collect core samples at depths of 1,000 meters below the seafloor. *Chikyu* has become indispensable for obtaining numerous hints about our planet Earth's history.

Scientists jogging on the helipad

—— How did you contact family and friends?
Masago: Most people used email. Others used the IP phones every day.

—— Were any special measures taken to enhance communication?
Moe: I made a photo list of all staff and displayed it aboard *Chikyu*.
Kuramoto: I could memorize most names before the expeditions, which helped communication.
Kimura: Many incidents occurred when the staff changed over. Since the first Expedition 314 was trouble-bound, I, as a Co-Chief scientist, held many onboard seminars on shift relief and staff changeover. Those seminars helped as a place of exchange.
Moe: Birthday parties were held 6 times during Expedition 314, so cake delivery was provided by the mess. A Halloween party and tea ceremonies in the specially equipped tea room aboard *Chikyu* were also held.
Curewitz: We had a Fondu party with the science party. The galley staff was a great help, and it was a great way to relax for a while during the high-stress of the later part of the Expedition. We played a lot of ping pong, have a lot of birthday parties, and several movie nights.

Expedition Diary Excerpts

21 September 2007 (First day of Expedition 314)
Weather: Fine
At 16:20 Chikyu departed the Shingu Port, heading for the first drilling site. At 1:00 the next day, arrived at C0001, and started drilling preparations. Safety guidance onboard and vessel tour was conducted. Group discussions identified necessary preparations.

15 November 2007 (Last day of Expedition 314)
Weather: Slightly overcast
Completed LWD at site C0006 at 19:00. Data processing was immediately started. Moved over to Site C0001 for Expedition 315 preparation. Data processing was finished and onboard researchers started to complete the expedition. Expedition 314 was finished at 24:00 on 15 November.

Strong bonds were made among people onboard because of time spent together. Shared time is always precious for all.

Kuramoto: Shared memories are precious even after the expeditions. We still recall them from time to time.

Kimura: The staff aboard the vessel are mates that have borne the same storms, and shared the same stresses. Many fresh postgraduates could share precious time, leading to good contacts for their future research activities.

Enjoying a moment off at an onboard party

Common features are pride to be involved in NanTroSEIZE. All related researchers are looking forward to getting data from below the seafloor. This project provides good opportunities for becoming prominent researchers.

Ashi: The planning phase of riser vessel drilling research through to actual drilling took more than ten years. Stage 1A results will be applied to future studies and be groundwork for scientists continuing to pursuing specific themes. I really appreciate the chance to become a member of such a large project.

Kimura: One mission of this project is to predict earthquakes, definitely needed. That is *Chikyu* for us, We are proud of being involved in the world's leading scientific vessel.

Finally, expectations for Following Expeditions:

Masago: The first riser drilling for scientific purpose will soon begin, and no doubt there will be various difficulties. I will try my best to help produce good results in collaboration with scientists from all over the world.

Kuramoto: Management of the previous expeditions helped me grow. My responsibility as a member had increased gradually, motivating me as the results came in, making me have a lot of positive influence to push for success in this big future project.

Researchers learned tremendously from the experiences. Keep an eye on future expeditions as well as on progress in the earth sciences!

Lab Brought Important Findings

Dr. Elizabeth Screaton
Expedition 316 Co-Chief Scientist
University of Florida (USA)

Many scientists including geologists, structural geologists and microbiologists got together and conducted research/analysis to enhance their understanding of the Nankai Trough Seismogenic Zone. Full core CT scan played a vital role in understanding borehole structure. Collecting the sediment in the fault was a major result.

16 November 2007 (First day of Expedition 315)
Weather: Clear star-filled night sky
Expedition 315 started from 0:00. Some researchers were onboard for takeover and preparation of the core sampling process. This expedition is scheduled to collect core samples at site C0001.

25 December (7th day of Expedition 316)
Weather: Cloudy
At 22:33 collected core samples from target zone 400 meters below the seafloor, at drill hole D of Site C0004, deeper than was expected from the previous LWD data. Obtained possibly interesting results by CT scan. The next drilling site is C0006, using a waterproof camera before starting drilling.

Solid Results Obtained from a Big Project

Faults Reveal Earthquakes' "Mechanism"

IODP NanTroSEIZE is a massive scientific project collecting samples from a subduction zone where earthquakes regularly occur, observing data obtained at the drilling site. NanTroSEIZE Stage 1A was the first fruitful step of this project, comprising expeditions conducted by Deep Sea Drilling Vessel *Chikyu* from 21 September 2007 until 5 February 2008.

NanTroSEIZE will be continued for several years to come, bringing together scientists from around the world. The main aim of this project is to drill several shallow to deep holes in the Nankai Trough, the epicenter of the East Nankai Earthquake (1944, M8 class), the "birthplace" of many massive shakes and tsunamis. It seeks to clarify the conditions causing earthquakes in the fault by retrieving coring samples and conducting long-term borehole measurements.

Expedition Continued Despite Severe Conditions

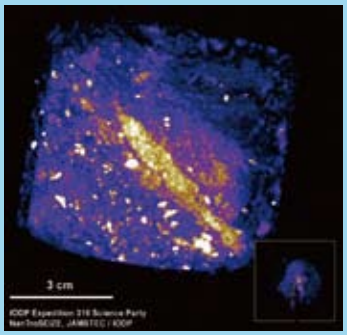
Drilling was conducted in the accretionary prism using various coring systems. Because riser-less drilling depth is limited in the complex accretionary prism layer, the drilling site was changed from time to time. There were also times when we tried to continue drilling by trying to improve the borehole conditions, based on drilling data acquired from the pilot hole. The greatest headache for the staff in this expedition, however, was the unexpectedly strong Japan Current which reached a maximum speed of 5.6 knots.

Core Sample Collection in the Megasplay Fault: Growing Expectations for Future Research

Overcoming numerous difficulties, the Stage 1A expeditions had good results, including Logging While Drilling (LWD) data, and core samples giving clues to how the geology around an earthquake occurring zone is formed.

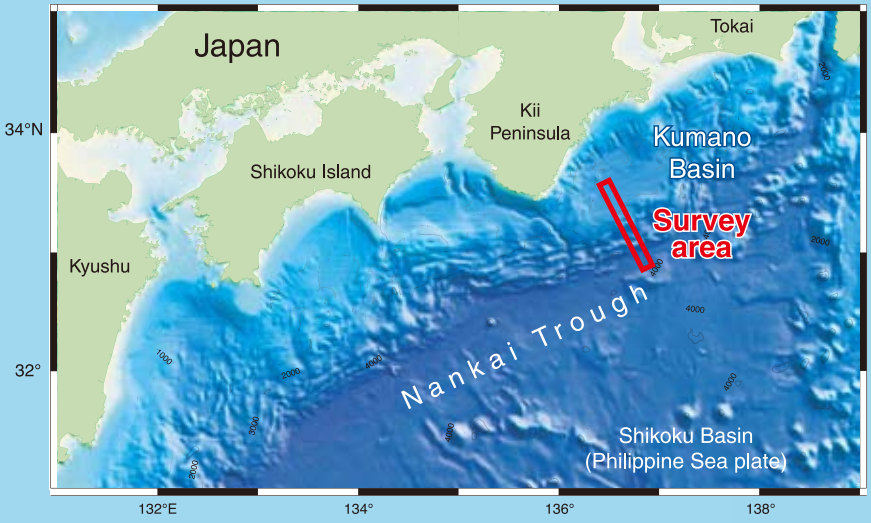
Expedition 314 achieved a record LWD drilling depth of 1,401.5 meters below the seafloor (Site C0002). Expedition 315 drilled to 1,057 meters below the seafloor (Site C0002), the deepest excavation of accretionary prism layer yet, while Expedition 316 collected core samples from the Megasplay fault (Site C0004) for the first time in history (refer to the table below).

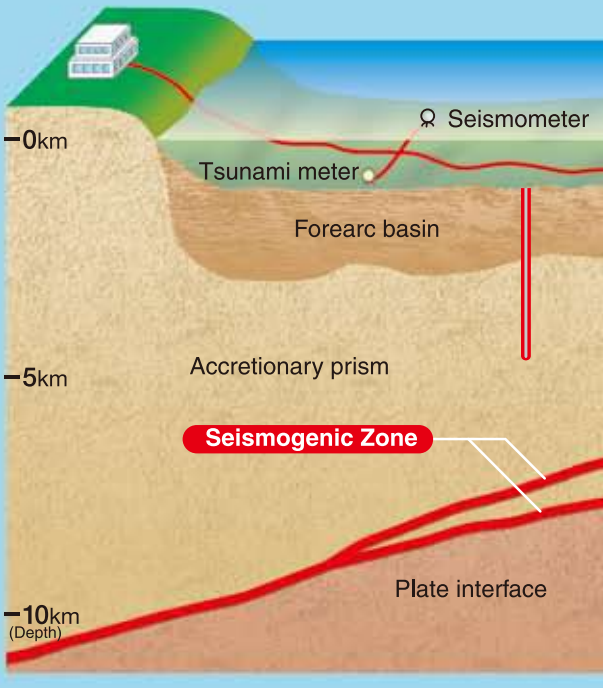
Core samples were also successfully collected from the shallow area of the plate's border fault, generating interest for future research. Core collections from the fault are indispensable in understanding how earthquakes occur, and are an outstanding achievement of this project.



CT scan of the core fault surface (in yellow) collected from the Megasplay fault

Nankai Trough Excavation Site Map





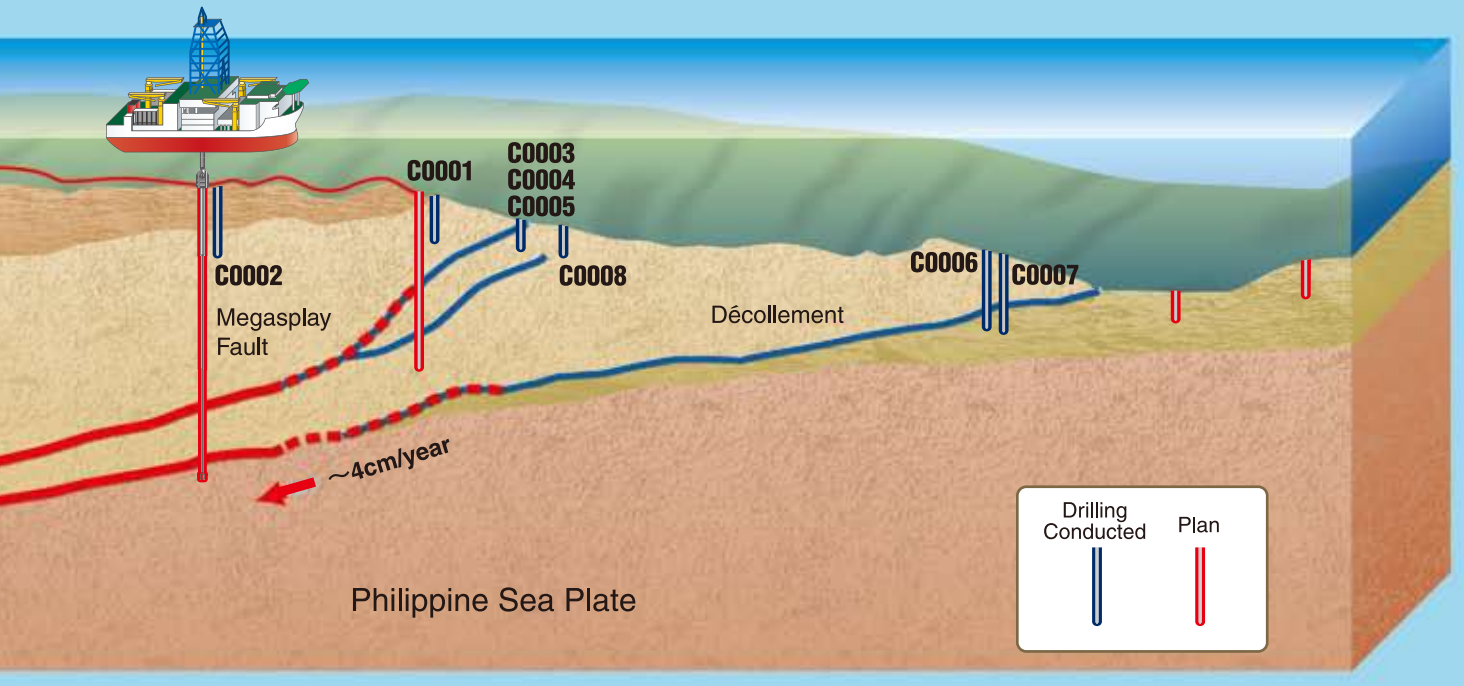
A meeting on aboard *Chikyu*

Heated discussions between researchers over a core that had just been recovered

The core barrel hauled from the seafloor

Brief Summary of NanTroSEIZE Stage 1A Results

Total number of days at sea:	138 (21 September 2007 – 5 February 2008)
Total onboard scientists :	67 people from 12 countries
Number of drilled points:	8 sites
Number of drilled boreholes	33 holes
Total drilled length:	12,800 meters
Core retrieval length:	2,200 meters
Logging While Drilling (LWD):	4,274 meters



NanTroSEIZE Stage 1A Expedition Overview

Expedition Name	Expedition 314	Expedition 315	Expedition 316
Voyage Term	21 September – 15 November 2007 (56 days)	16 November – 18 December 2007 (33 days)	19 December 2007– 5 February 2008 (49 days)
Co-Chief Scientists	**Dr. Masataka Kinoshita** IFREE/ JAMSTEC **Dr. Harold Tobin** University of Wisconsin-Madison (USA)	**Dr. Juichiro Ashi** The University of Tokyo **Dr. Siegfried Lallemant** Université de Cergy-Pontoise (FRANCE)	**Dr. Gaku Kimura** The University of Tokyo **Dr. Elizabeth J. Screaton** University of Florida (USA)
Science Party	16 onboard scientists from six countries	25 onboard scientists from six countries	26 onboard scientists from 10 countries
Drilling Overview	**The "Big Picture" of Nankai Trough** Simultaneously performed excavation work and physical measurements of collapsed seabed sediments affected by the stress of plate subduction. Acquired valuable data on the stress and geological structure of a seismogenic zone 1,000-1,400 meters below the seabed.	**Collected Core Directly Above the Seismogenic Zone** Collected core samples at 458 meters and 1,057 meters below the seabed in the accretionary prism and Kumano fore-arc basin. The scheduled upper hole installment was postponed because the force of the Japan Current was deemed too strong.	**Successfully Collected Fault Zone Core, Accelerating Detailed Research** Collected core from the plate boundary fault where the superficial part of the Megasplay fault and the Philippine Sea plate subduct, and excavated four sites. Future research is expected.

Researchers on deck (314th)

Core sample analyses (315th)

Chikyu returns to port (316th)

On-vessel discussion

Researchers analyzing the data

Around the clock drilling

Expedition Flash Report

Expedition flash report will summarize each expedition and will be available in English at the IODP's website. The results of the expedition will be published by IODP in February 2009.

IODP website: **http://www.iodp.org/scientific-publications/**

The data collected by *Chikyu* includes descriptions of the core, micro fossils, X-ray CT scan images, photos of the half-split core by excavation borehole as well as logging data. Only on-board researchers can access to the data for one year after the expedition, but all data will be made public at the end of the moratorium period, scheduled for 5 February 2009.

Chikyu Lab Data Center: **http://sio7.jamstec.go.jp/**

Following NanTroSEIZE Stages Plans

NanTroSEIZE progresses: drilling first at shallow regions for the overall picture, proceeding to deeper areas of Megasplay fault, and long-term monitoring the area by a borehole observatory.

Stage 2

The first riser drilling for scientific purpose is planned at just above the seismogenic zone of the Tonankai Earthquake for future development of a long-term borehole observatory. Coring as well as logging data will be obtained.

Stage 3

Drilling 5,500–6,000 meters deep into the seismogenic zone is planned. Sampling from the seismogenic zone as well as logging data will also be collected.

Stage 4

Long-term observatory systems will be installed into the two ultra-deep boreholes. One exciting possibility is that the NanTroSEIZE boreholes ultimately could be connected to a seafloor network in Stage 4, allowing real-time access to earthquake data.

Chikyu Coring System

How Are the Various Stratal Core Samples Collected?

Technology Meets Scientists' High Demands

*Chikyu*s coring system plays an important role in collecting core samples to clarify how earthquakes and tsunamis occur, as well as the structure and the history of the Earth. NanTroSEIZE Stage 1A Expedition utilized several coring systems, successfully collecting numerous core samples from deep sea geological layers of different depths and conditions. The coring types and systems are described below:

WLC (Wire Line Coring) System

*Chikyu*s coring system consists of a sample collecting device with a core bit, barrels and onboard equipment such as core line winch and sinker bar. The Rotary Core Barrel Sampling System (RCB) and the Extended Shoe Coring System (ESCS) operations are performed by:

First, the inner barrel is mounted inside the drill pipe from the vessel, and placed on the outer barrel that is located directly above the bit. The core bit, with a central opening, digs into deep sea sediments and layers while collecting the core into the inner barrel every 9.5 meters.

Next, the wire line is lowered into the drill pipe to latch onto the inner barrel filled with the core sample, and pulls it up to *Chikyu*, where scientists from various specialties await.

WLC avoids lost time and facilitates quick analysis because it does not require the entire drill pipe to be hauled onboard whenever a core is retrieved.

Three Coring Systems

Hydraulic Piston Core Sampling System (HPCS): Collects unconsolidated soft sedimentary layers

- Size of collected core: 62 mm (inner diameter) X 9.4 m (length)

HPCS is a coring system that collects soft layers close to the surface of the seafloor. It extracts the core with a thin, tubular inner barrel that penetrates the seafloor, using water pressure running from the tip of the core bit instead of collecting the core with a core bit.

I. Water pressure added to the core barrel from a mud pump onboard Chikyu (Fig. 1)
II. The shear pin(s) break(s) (The layer s hardness determines the number of shear pins)
III. Only the piston exterior (the tubular part of the core barrel) is forced out.
IV. Lift up the entire pipe and keep it afloat
V. Lower the wire line and latch, collecting the inner barrel
VI. Dig in only as far as drill bit penetration

ESCS: Collects consolidated sedimentary layers and soft-and-hard-mixed geological formations

- Size of collected core: 58 mm (inner diameter) X 9.4 m (length)
- With soft layers: The installed cutting shoe* protrudes fromthe tip of the core bit to collect the core (left of figure). Liquid blows out from the bit to cool and clear away cutting edges. With soft layers, the extended cutting shoe avoids having the liquid blow away the core.
- With hard layers: The cutting shoe is drawn into the core bit. The core bit itself can cut strata. The spring allows it to expand, showing the hardness of the layer.

*Cutting shoe: A knife-like component that extends from the tip of the core bit to extract geological layers.

RCB: Collects consolidated (middle-hard) lithological layers

- Size of collected core: 59 mm (inner diameter) X 9.5 m (length)
- RCB is most often used in riser drilling, and its coring target is the middle-hard lithological layer. The inner barrel is supported by bearings, allowing the collection of cores without rotation of the inner barrel, even though the external core bit and outer barrel rotates.

Safe and Quick Collection with High Recovery Rates

Based on previous expeditions results, our role as engineers for the next expeditions is quite clear, says Kazuyasu Wada, a member of the CDEX Engineering Department, which develops the coring system. Required system improvements include: stable operation; high core recovery rate for all types of layers (including consolidated, unconsolidated, sand or mud); core quality maintenance; core catcher** improvement and; optimized operations.

Kazutaka Higuchi, who operates and manages the system said, “We must always consider ways to improve the coring system to allow for its safe, quick and sure operation.”

**Wedge-shaped barb that prevents the collected core from dropping out of the inner barrel.

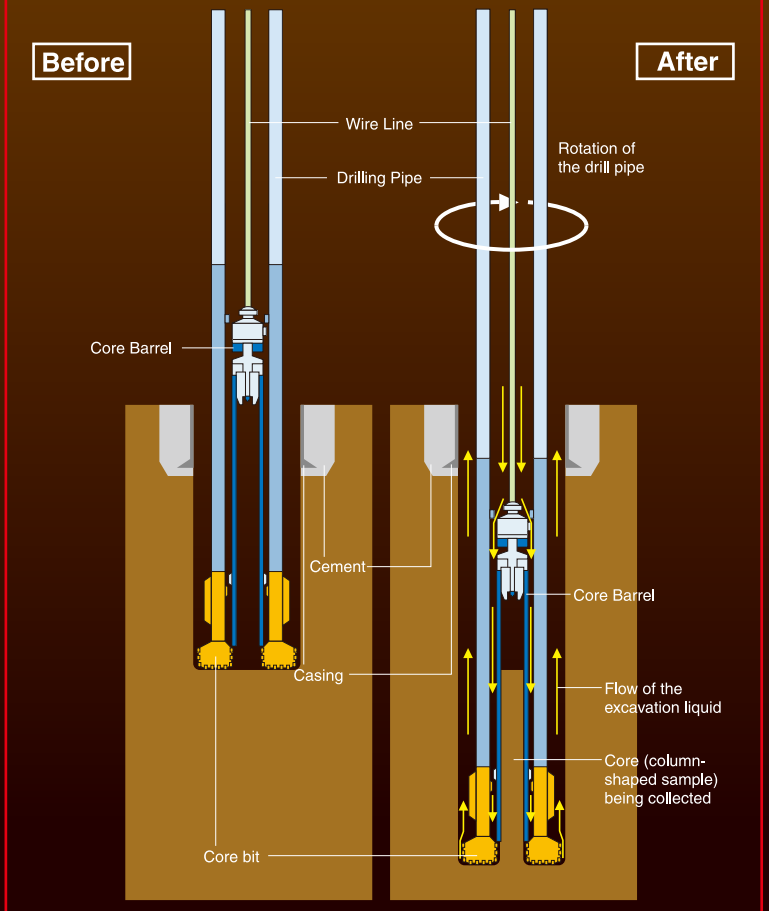
The inner barrel pulled out of the drill pipe

The 9.5 meter-long inner barrel placed sideways

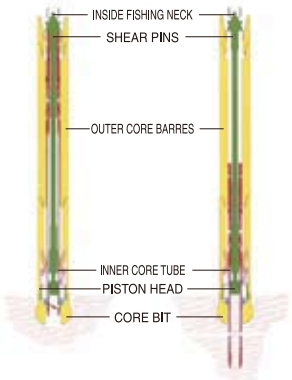
The core being removed from the inner barrel.

Core Bit

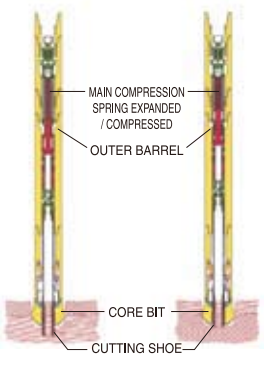
Rotary Core Barrel Sampling System (RCB)



HYDRAULIC PISTON CORING SYSTEM (HPCS)



EXTENDED SHOE CORING SYSTEM (ESCS)



Dynamism of the Subseafloor Biosphere

Dr. Inagaki with archive-half

Recent microbiological results have suggested that a massive biosphere exists in the oceanic crust, which composes 70% of the Earth's surface. The number of microbial life in this biosphere may greatly exceed the biomass on land. Habitat of life below the deep seafloor, without sunlight, is far beyond our imagination and is being revealed. Systematic studies of microbial life in deeply buried marine sediments have launched since 2002, Ocean Drilling Program (ODP) Leg 201 offshore the Peru Margin and South Equatorial Pacific; learning more about the subseafloor life and biosphere is one of IODP's top three scientific objectives.

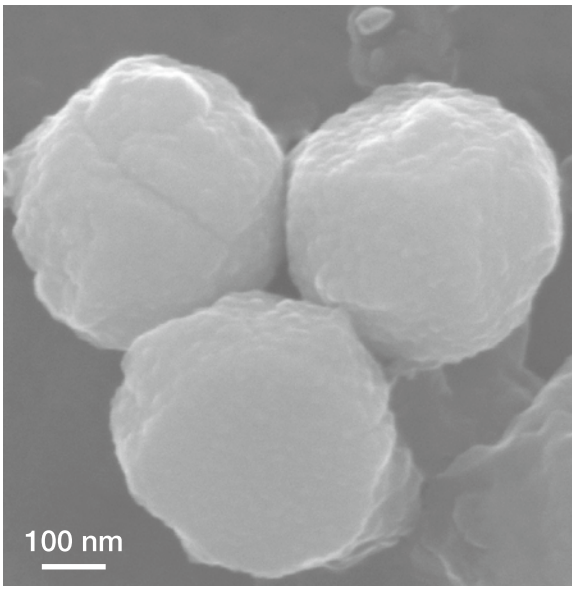
"Research has only begun in studying the diversity, distribution and metabolic activities of microbes that live in these low-energy-flux environments," says Fumio Inagaki, group leader of the Kochi Core Center, JAMSTEC. "Recent studies have revealed that microbial life is alive well even in very deep and old marine sediments, but the functioning of most genealogies remains largely unknown."

Molecular Biological and Biogeochemical Approaches

What is the nature and extent of deep subseafloor life? How do they affect global biogeochemical cycles? These fundamental questions are being answered using core samples collected by *Chikyu*. "Our research has shifted from grasping the bulk image of microbial assemblages to clarifying the metabolic function and relatedness on a single cell level," Dr. Inagaki explained. "We used to analyze the bulk DNA and lipids extracted from a sediment sample," he continued. "But it is difficult to figure out the metabolic pathways and growth characteristics of individual phylogenic species. So the state-of-the-art analytical approach combining molecular biology and biogeochemistry is necessary for braking through," he explained.

How does microbial population and activity correlate with energy and fluids flow along the seismogenic faults on the accreationary prism? Does life exist in the high-temperature, high-pressure environments thousands of meters below the seabed?

Further analysis will reveal the expanse of the biosphere in the earth as well as its geological links with the environment; future IODP projects will dramatically advance bioscience.



Scanning electron microscopic image of microbial cells in cored sediments offshore the Shimokita Peninsula by *Chikyu* during its shakedown expedition.

Professional Drillers

Chikyu Operations Group

Ikuro Sawada / Tsuyoshi Abe / Toshikazu Saruhashi

Ikuro Sawada (Center)

Chikyu Drilling Operation Management

Professional drilling engineers of CDEX played a key role in the series of drilling operations. Despite having abundant experience in commercial drilling in the Middle East and Southeast Asia, they spent many sleepless nights aboard *Chikyu*.

Commercial drilling is usually conducted in a short time under milder conditions; however, this research expedition was challenging due to weather, accidents and sea conditions, especially the Kuroshio current. In Expedition 314, the Logging While Drilling (LWD) equipment got trapped in the borehole. "We did everything possible, but we could not retrieve it," recalls Mr. Sawada, the Operation Super Intendent (OSI), responsible for overall operation manegement. He said that "unprecedented events happened in Expedition 314."

Tsuyoshi Abe, another OSI, said he "couldn't look away from the TV monitor showing places such as the drill floor, while resting in my room." Because he was responsible for observing the entire drilling process, he "…only slept a few hours (as) important messages and consultations needing my instructions always seemed to occur at midnight. The moment I closed my eyes, I was jolted awake by a knock on the door."

Tsuyoshi Abe (Right)

Ikuro Sawada (Left), Toshikazu Saruhashi (Right)

Extremely Tense Job

OSIs, drilling engineers, and well site geologists formed teams on 12-hour shifts.

Toshikazu Saruhashi, a drilling engineer, forced himself to "…work safely and infallibly, paying attention to the drill floor in consultation with OSI's approval, judgment and instruction". He paid extra attention "…between midnight to dawn." Mr. Saruhashi, who worked two-week shifts like Mr. Sawada and Mr. Abe, stayed up until a helicopter flew him back to land.

Even off duty, they regularly read reports and prepared for their next tour. Once aboard, they resumed their professionalism, supporting the scientists.

Find out the latest information on IODP and *Chikyu* !

Latest event information

Information on IODP and *Chikyu* is displayed at various events and lecture meetings. It's a great opportunity for you to learn about the latest topics on scientific drilling. Come visit us!

Public lecture: **"Thinking about" the Next Nankai Earthquake & Tsunami** 31 Aug. (Sun.), 2008
Venue: **Main hall at Kochi City Culture Plaza Cul-Port**

Symposium: **NanTroSEIZE *Chikyu* (tentative title)** 20 Oct. (Mon.), 2008
Venue: **In Tokyo (planned)**

7th International Symposium for Subsurface Microorganism 16-21 Nov. (Sun.-Fri.), 2008
Venue: **Shizuoka Convention & Art Center, "GRANSHIP"** IODP Exhibition!

American Geophysical Union (AGU) 2008 Autumn Meeting 15-19 Dec.(Mon.-Fri.), 2008
Venue: **Moscone Center (San Francisco)** IODP Exhibition!

Event Report

Chikyu expedition highlights were displayed at the IODP booth.
Many people visited us. Thank you very much!

Japan Geoscience Union Meeting, 2008
25-30 May ,2008 at Makuhari (Japan)

Asia Oceania Geoscience Society 5th Annual General Meeting
16-20 June,2008 at Busan (South Korea)

Register for the "*Chikyu* Mail News!"

Get the latest information on *Chikyu* and IODP-related events.
Register online for email news subscriptions!

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Back numbers are also available here:
http://www.jamstec.go.jp/Chikyu/jp/mailnews/index.html

Japanese Islands: Enhanced Understanding of Earthquakes

Effectiveness of Logging While Drilling (LWD) Technology

NanTroSEIZE Stage 1A acquired high-quality LWD data and core samples of the fault. Core samples from a layer 1,000 meters below the seafloor were difficult to collect, but on-board analysis revealed that the stress, or distortion energy, several hundred to one thousand meters below the seafloor drastically changes after the Mega splay fault.

The results of Stage 1A brought us one step closer to clarifying stress under the seafloor, but how do sinking plates affect the geological layer that stores the stress? *Chikyu* will collect more detailed data and continue to lead important research in the years to come.

One exciting, as well as on-going research focus on accretionary prism is that analyses of the petrographic structure, mineral substance and the pore water suggests the speed of the prisms' growth.

Large Framework of Earthquake Mechanism

The expedition has provided extensive data related to the structure of the Japan midlands, the accretionary prism of the Nankai Trough zone, the movement of the earth's crust, and the geological age of Japan.

Receiving east-west stress, inland (Hyogo, Noto Peninsula, Shimane, Niigata, Iwate, Miyagi, etc.) earthquakes in Japan were thought to be closely related to plate boundary earthquake activity in the Nankai Trough. Stage 1A data shows the linkage of earthquake occurrence in the Japanese islands to a larger framework. The data raised important questions about the connection between Japan and ocean trenches when using earthquake tectonics to explain the relationship between the crust's structural movement and the occurrence of earthquakes.

Fast Japan Current

We experienced the Kuroshio Current flowing at the enormous speed of 5.6 knots (10 km/h). The drill pipe groaned and the entire vessel was pushed around; this may be related to recent oceanic climate change.

Our research requires a lot of flexibility, taking climate and current into consideration, in addition to scientific objectives and drilling technology.

Exploring the Earth Itself

NanTroSEIZE is a long-term research project. We believe that the important findings by scientists and engineers from around the world will surely bring a lot of benefits to society. The scientists aboard *Chikyu* are now studying how pore water affects the slippage of subterranean rock, including in the Mega splay fault.

The challenge continues. To predict the occurrence of earthquakes on a real-time basis, the Long Term Borehole Measurement System is being developed. Although we will meet many challenges, we nevertheless look forward to the next expedition. This is because *Chikyu*, has the important mission of clarifing the mechanisms of earthquake/tsunami occurrence, which goes to the heart of Mother Earth herself.

With Dr. Arden L. Bement, Director of the National Science Foundation (NSF), a lead IODP agency.
Discussion on future cooperation in Washington D.C.

Close Up

Chikyu Greets the First Sunrise of 2008

Science party of NanTroSEIZE Expedition 316 spent Christmas and the first day of 2008 aboard *Chikyu*. This photo is of the first sunrise of 2008 over the derrick and was taken from the helicopter deck.

Dr. Sakaguchi, recalls that "…we were so busy even during Christmas and New Year's, turning off the light at countdown for ten seconds, applauded and, after a minute, went back to work." This first sunrise from the helicopter deck reflects the sense of fulfillment and joy of all those aboard *Chikyu*. (Photograph taken by Dr. Arito Sakaguchi, IODP NanTroSEIZE Expedition 316 onboard scientist.)

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