October 9, 2009
Japan Agency for Marine-Earth Science and Technology

Integrated Ocean Drilling Program (IODP) Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) Deep-Sea Drilling Vessel *CHIKYU* Successfully Completes Expedition 322 "Subduction Inputs"

1) Overview

The Deep-Sea Drilling Vessel *CHIKYU*, operated by the Japan Agency for Marine-Earth Science and Technology (JAMSTEC: Yasuhiro Kato, President), has been engaged in drilling expeditions for the IODP (*1) Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) (*2) Stage 2 since May 10th, in the Kumano Basin, off the Kii Peninsula. Upon completion of the ongoing Expedition 322, scheduled to be on October 10th, the *CHIKYU* will complete all of her drilling operations for the 2009 IODP NanTroSEIZE program.

2) Summary of operations

Expedition 322 conducted riserless drilling to investigate input material before being transported to the seismogenic zone for large earthquakes. The drilling operations were carried out at Sites C0011 [NT1-07] and C0012 [NT1-01] in the Shikoku Basin, the back-arc basin of the IZU-Bonin volcanic chain, where the Philippine Sea plate dives down at Nankai Trough (Fig. 1).

At the first Site C0011, scientists began coring from a depth of 340 meters below the seafloor. The coring, however, had to be abandoned at a depth of 881 meters due to deterioration of core quality caused by a significant decrease in drilling speed. At the second Site C0012, coring was carried out from depths between 60 meters and 576 meters below the seafloor, and successfully collected targeted sedimentary and basement (*3) rock samples. The summary of coring operation is shown in Appendix.
Dr. Saneatsu Saito (Principle Research Scientist, JAMSTEC) and Dr. Michael Underwood, Professor at University of Missouri are the Co-Chief Scientists, and joined by the science party comprises 26 onboard scientists from eight countries (Photo 1).

3) Summary of achievements

- Characterizing input sediments and basement rock entering to the seismogenic zone for great earthquakes -

Scientists observed, measured, and analyzed cores collected at Sites C0011 and C0012 in onboard laboratories to characterize sediments and basement rock before being transported to the seismogenic zone at the Nankai Trough by the subduction of the Philippine Sea plate.

1. Volcanic material supply to Shikoku Basin

In the formations of 5 to 11 million years old, coarse volcanic sediments were confirmed in large quantity. Architecture and composition of these sediments suggests that these sediments may have been transported from the easterly located volcanic chain (Izu-Bonin Arc) to the westward, via submarine canyons or alluvial fans spreading on the seafloor. They were the first coarse volcanic sediments collected by drilling on the Shikoku Basin, and are of great importance in terms of characterizing the material transported into the seismogenic zone of the Nankai Trough.

2. Sediment supply from southwestern Japan

Sandstones found in formations up to 1.1 to 1.6 million years old contained abundant minerals derived from land, implying the extensive supply of sand to the Shikoku Basin from the Japanese islands. Beneath these sediments, are lying felsic (*4) volcanic deposits. Such sedimentary features suggest a wide distribution of volcanic sediments originated from the outer zone of the southwestern Median Tectonic line of Japan, the area with increasing volcanic activity in the above geological time.

3. Two types of groundwater running beneath the seafloor

The analysis of pore water retrieved from the formation confirmed two types of groundwater in a layer rich in middle-Miocene sandstones and in a layer overlaying the basement. The analysis of these waters indicates the multiple sources and migration paths of fluids. These results have important implications for understanding the properties of fluids within the seismogenic zone.

4. Identification of sediment /basement interface, and the collection of basement samples

At Site C0012, scientists identified an interface of early Miocene sediment (approximately 1.6 to 2.3 million years ago) and basement rock at 540 meters below the seafloor and successfully sampled basaltic pillow lava rocks that make up the basement (Photo 2). Theses rocks are considered to form asperities (*5) after they are transported to the seismogenic zone. Studying their petrological, mineralogical and geotechnical properties prior to subduction is expected to contribute significantly to the understanding of rupture dynamics in the seismogenic zone.

5. Downhole geophysical properties by the comparison of cores and LWD data (*6)

At the final stage of Expedition 319, which was carried out prior to Expedition 322, geophysical information (resistivity, natural gamma ray, etc.) of Site C0011 was obtained by logging while drilling (LWD). The data were analyzed during Expedition 322, and the rock type and physical properties of the site were compared with those of sampled cores. The analysis of the borehole wall imagery of C0011 was also analyzed, allowing scientists to gain information about stresses in the formation below.

4) Future schedule for the *CHIKYU*

October 10	Port call at Shingu Port, Wakayama Prefecture
October 17 and 18	Open house at Shingu Port

October 19	Sail out from Shingu Port
October 22 to 31	Instruments Installation and other maintenance work at Honmoku Plant, Mitsubishi Heavy Industries Yokohama Dockyard & Machinery Works
From November 1	Training Cruise

* The above schedule is subject to change depending on the progress of drilling operation and weather.

***1. The Integrated Ocean Drilling Program (IODP)** is an international marine research drilling program dedicated to advancing scientific understanding of Earth by monitoring, sampling, and instrumenting subseafloor environments. Through multiple platforms, preeminent scientists explore IODP principal themes: the deep biosphere, environmental change, and solid Earth cycles. IODP has operated since October 2003, funded jointly by the Japan Ministry of Education, Culture, Sports, Science and Technology and the U.S. National Science Foundation. Additional support is provided by the 17-member European Consortium of Ocean Research Drilling, the People's Republic of China, the Republic of Korea, Australia, India, and New Zealand.

***2. Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE)**
The Nankai Trough is a subduction zone located southwest of Japan, stretching from off the coast of Tokai region to Shikoku. It is a place where the Philippine Sea Plate slides beneath the Eurasian plate and is one of the most active earthquake zones on the planet. The Kumano Basin, off the Kii Peninsula, is a forearc basin of the Nankai Trough subduction zone. The area inferred to be responsible for great earthquakes including the 1944 Tonankai earthquake, is located at a depth of about 6,000 meters below the seafloor, much shallower than those of other plate boundaries in the world, and is within the operational limits of riser drilling by the *CHIKYU*.
The IODP Nankai Trough Seismogenic Zone Experiment is an ocean drilling project that drills in the plate boundary fault and the megasplay fault believed to have generated tsunami. It aims to gain insight into the transition from aseismic to seismic slip within the plate boundary fault zone, as well as the processes of earthquake or tsunami occurrences, by collecting geological samples (core samples) and measuring downhole conditions.

The drilling project consists of four stages in all, planned to conduct drilling operations at several sites located along a line orthogonally crossing the Nankai Trough region from Shikoku Basin (seaward) to Kumano Basin. The first stage was carried out between September 21st, 2007 and February 5th, 2008.

***3. Basement rock** is a formation beneath sedimentary rocks and covers the area extensively.

***4. Felsic** is a term used to refer to quartz- and feldspar-rich material.

***5. Asperity** is a point at which a large seismic slip occurred and generated earthquakes.

***6. Logging While Drilling (LWD)** is a technique to measure geological formation properties at a site while drilling, by attaching a physical measurement sensor near the drill bit. With this technique, core is not sampled; however, geophysical information at the drilling site can be obtained in real time through continuous in-situ monitoring during drilling.

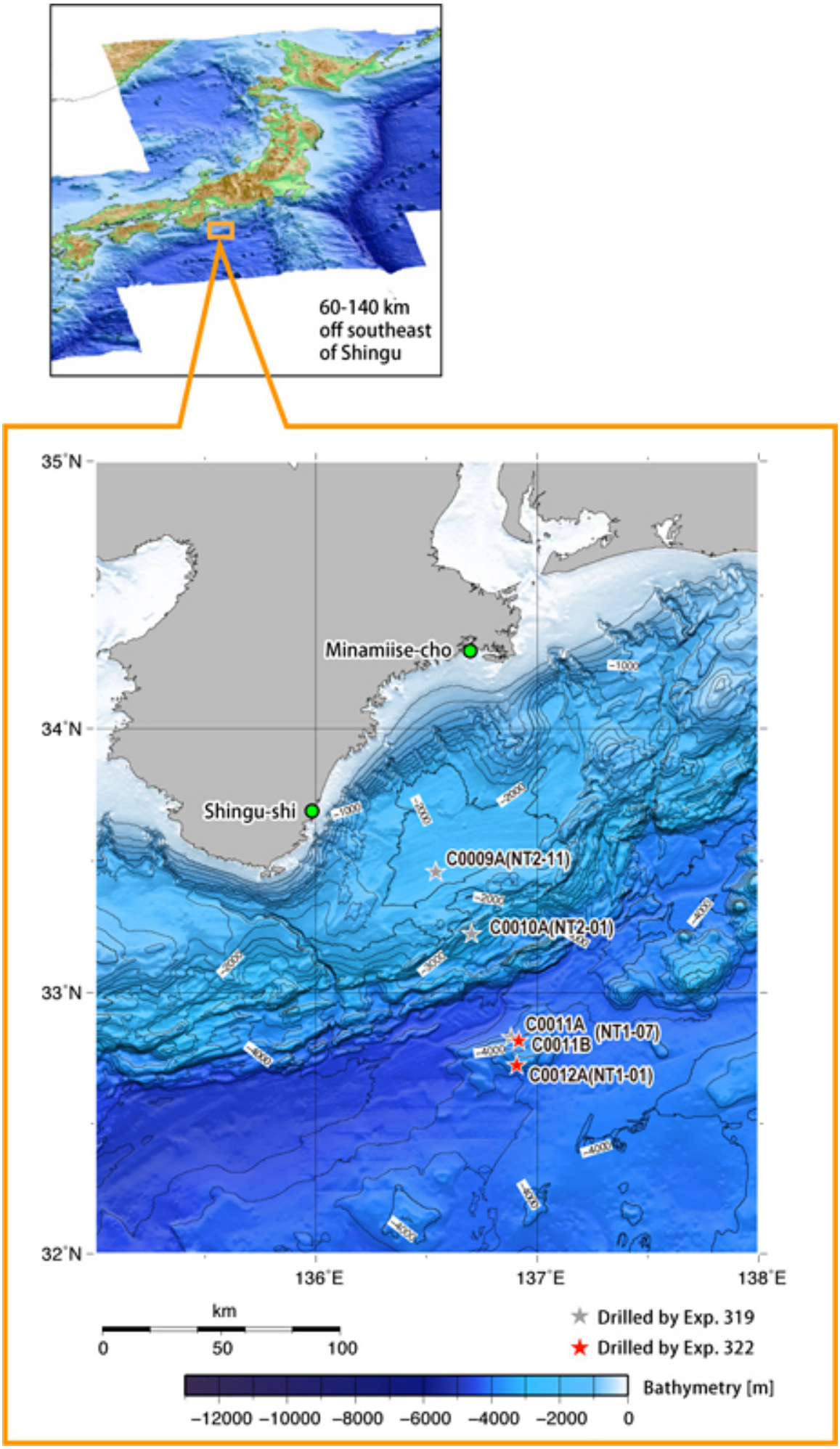


Figure 1: Survey area

Photo 1: Scientists document and sample cores

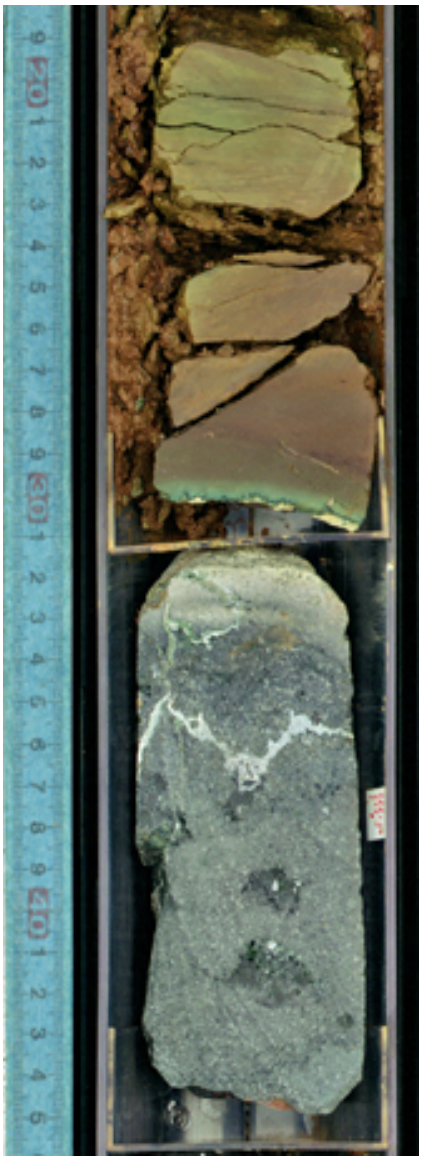
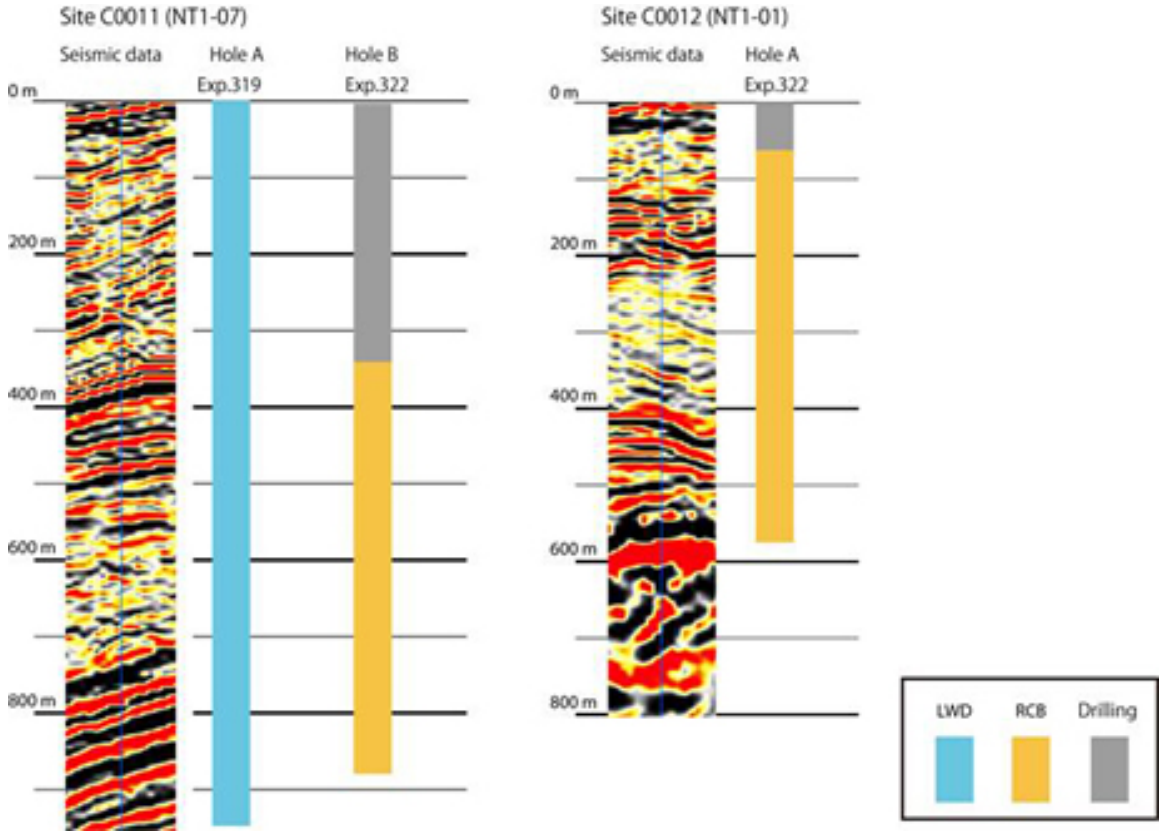


Photo 2: Boundary of sedimentary rock (upper half) and basaltic

basement (lower half) obtained at C0012

Appendix

Summary of coring operation



Drill site:C0011(Proposed site:NT1-07)			
North Latitude:32°49.7’ East Longitude:136°52.9’			
Hole name	Water depth (below sea level)	Core sampling depth (below seafloor)	Summary of operations
B	4048.7m	340 - 881m	Coring by Rotary Core Barrel Sampling System(RCB). Collection of sediment samples up to 881 meters below the seafoor.

Drill site:C0012(Proposed site:NT1-01)

North Latitude:32°44.9’ East Longitude:136°55.0’			
Hole name	Water depth (below sea level)	Core sampling depth (below seafloor)	Summary of operations
A	3510.7m	60 - 576m	Coring by Rotary Core Barrel Sampling System(RCB). Collection of sediment and basement samples.

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