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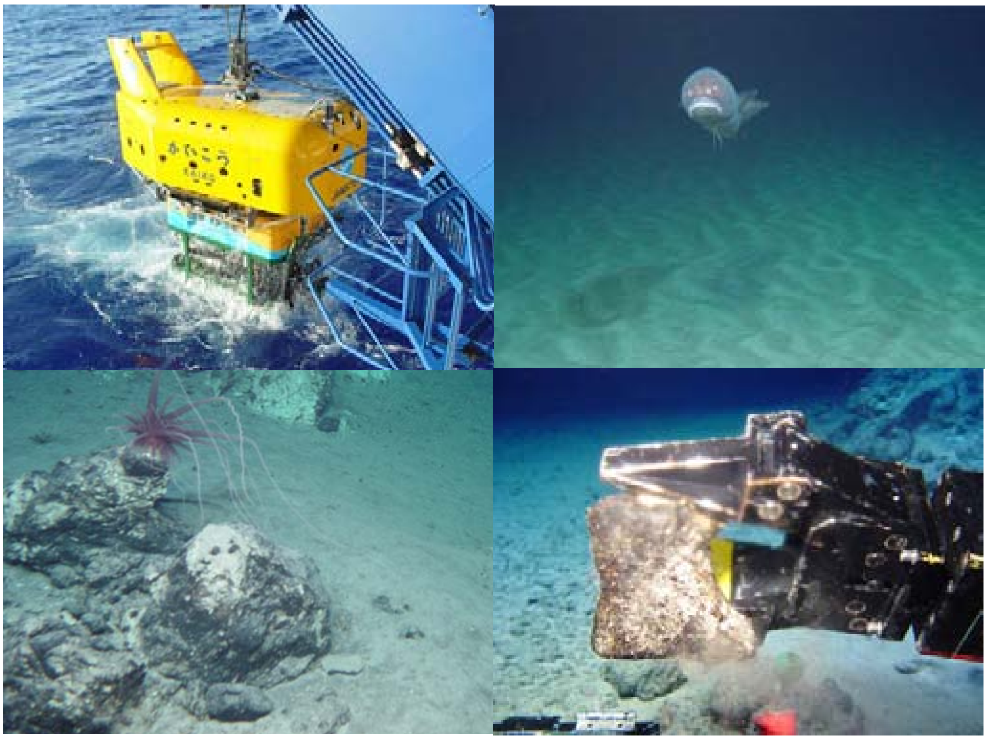
KR06-15 Cruise Report
Geological expedition of the serpentinite seamounts in the Mariana forearc



November 24 – December 12, 2006 (Yokosuka to Guam)

Japan Marine Science & Technology Center

Scientific party

Chief Scientist

Hirokazu MAEKAWA

Vice Chief Scientist

Kantaro FUJIOKA

Stuff Scientist

Hitoshi CHIBA
Koshi YAMAMOTO
Hisayoshi YOKOSE
Yutaka WADA
Yukihisa OSADA
Ken-ichi HIRAUCHI
Yuta FUJIMOTO
Hajime SATO
Nanami MAEDA

Marine Technician

Morifumi TAKAESU

"R/V KAIREI" Crew

Captain Sadao ISHIDA

"KAIKO 7000II" Operation Team

Commander Kazuyoshi HIRATA

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Acknowledgements

We are grateful to Captain Mr. S. Ishida, Chief Officer S. Susami, and Chief Engineer Y. Shibata for their safe navigation and their skillful handling of "R/V Kairei". Great thanks are due to Commander Mr. K. Hirata and "KAIKO 7000II operation team for accurate operation of KAIKO 7000II. We also thanks Mr. M. Takaesu, Nippon Marine Enterprise, Ltd., for their attentive supports. Finally, we thank all the JAMSTEC personnels who have supported us for this cruise.

Confidentiality

Data and samples obtained during this cruise, most of which are described in this report, should be treated as carefully as possible, in order to protect the priority of the cruise participants.

Confidential and publication policies are as follows:
(1) The participants aboard the KR06-15 Leg 1 cruise agreed the future study plan discussed in wrap-up meeting and the plan will be listed in the cruise report.
Those appeared in the lists have the priority for each study topics.
(2) No one other than the cruise participants or those listed in the future study plan can submit papers or give oral (or poster) presentations using any data and/or samples of this cruise within 12 month after the completion of the cruise (December 12, 2008).
(3) Any questions on the data and samples of this cruise, or on the future study plans must be forwarded to chief scientist (H. Maekawa).

Cruise Structure

The KR06-15 cruise aboard the R/V Kairei (JAMSTEC) were planned to carry out the two projects in the Mariana Trench area. The first project (Leg 1, Nov. 24-Dec. 8, 2006) was planned to investigate the serpentinite seamounts in the Mariana forearc to clarify the tectonic development of forearc area, formation mechanism of serpentinite seamounts, and the nature of subduction zone metamorphism (PI: H. Maekawa). The second (Leg 2, Dec. 9-12, 2006) was planned by Jamstec (PI: H. Nakajyo) to recover sediments from the bottom of more than 10000 m at Charenger Deep for DNA analysis of microbes, and to examine performance of Lancher and cable by 10000 m class dive. We will describe the outlines and results of Leg 1 cruise in this report.

List of Participants

Chief Scientist

Dr. Hirokazu MAEKAWA
Department of Physical Science, Graduate School of Science
Osaka Prefecture University

Vice chief Scientist

Dr. Kantaro FUJIOKA
Senior Scientist
JAMSTEC IFREE

Stuff Scientist

Dr. Hitoshi CHIBA
Department of Earth Sciences
Okayama University

Dr. Koshi YAMAMOTO
Graduate School of Environmental Studies
Nagoya University

Dr. Hisayoshi YOKOSE
Earth & Environmental Sciences
Graduate School of Science and Technology
Kumamoto University

Dr. Yutaka WADA
Department of Earth Sciences
Nara University of Education

Mr. Yukihisa OSADA
Department of Material Science, Graduate School of Science
Osaka Prefecture University

Mr. Ken-ichi HIRAUCHI
University of Tsukuba
Doctoral Program in Earth Evolution Sciences
Graduate School of Life and Environmental Sciences

Mr. Yuta FUJIMOTO
Earth & Environmental Sciences, Graduate School of Science and Technology
Kumamoto University

Mr. Hajime SATO
Department of Science
Kumamoto University

Ms. Nanami MAEDA
Department of Earth Sciences
Okayama University

Marine Technician

Mr. Morifumi TAKAESU
Marine Science Dept.
Nippon Marine Enterprises, Ltd.

ROV KAIKO 7000II Operation Team

Chief ROV Operator	K. HIRATA
1st ROV Operator	K. MITSUFUJI
2nd ROV Operator	T. MIURA
2nd ROV Operator	K. TAKISHITA
2nd ROV Operator	H. WAKAMATSU
2nd ROV Operator	H. SEZOKO
3rd ROV Operator	S. SHIGETAKE
3rd ROV Operator	K. MIYAKE
3rd ROV Operator	Y. TAYAMA

R/V KAIREI Crew

Captain	S. ISHIDA
Chief Officer	S. SUSAMI
2nd Officer	N. KIMURA
3rd Officer	J. TAKAO
Chief Engineer	Y. SHIBATA
1st Engineer	K. KANEDA
2nd Engineer	W. KUROSE
3rd Engineer	N. TAKAHARA
Chief Electronics Operator	H. SAITAKE
2nd Electronics Operator	K. TAKAKUSU
3rd Electronics Operator	Y. KOMAKI
Boat Swain	S. ABE
Able Seaman	S. SASAKI
Able Seaman	O. TOKUNAGA
Able Seaman	K. SATO
Able Seaman	T. KUBOTA
Able Seaman	K. SHIKAMA
Able Seaman	S. FUJII
No.1 Oiler	M. KITANO
Oiler	M. SIINO
Oiler	K. MIYAZAKI
Oiler	S. WATANABE
Oiler	Y. YAMAOKA
Chief Steward	T. MORITA
Steward	J. NAKATSUKA
Steward	H. FUKUMURA
Steward	Y. CHIKUBA
Steward	K. NAGANO

I. Cruise summary

Geological expedition was conducted by means of ROV KAIKO 7000II and its mother vessel R/V KAIREI in the forearc seamounts west to the Mariana Trench from November 24 to December 8, 2006. The ship left Yokosuka on November 24, 2006 for the survey area. After four days, we started our survey, and successfully conducted six dives at six forarc seamounts, that is, Conical Seamount (Dive #369), Pacman Seamount (Dive #370), Twin Peaks 3 Seamount (Dive #371), Big Blue Seamount (Dive #372), Unknown 1 Seamount (Dive #373), and Turcuoise Seamount (Dive #374). Based on these dives, we understood that there are two types of seamount or mound. One is the cone-shaped or dome-shaped seamount, such as Conical, Pacman, Twin Peaks 3, and Turcuoise Seamounts. In these seamounts, main constituents are serpentinite and serpentinized peridotite, and gravity flows of serpentinite materials often made ridges on the surface of the seamounts. Another is the fault-bounded irregular-shaped seamount or ridge, such as the eastern ridge of Big Blue Seamount and Unknown 1 Seamount. Shapes of their outlines are strongly controled by faults. Main constituents are igneous rocks, and serpentinized peridotite or serpentinite seems to be not common. We consider that the latter type is not "serpentinite seamount", but may be horst blocks of basal oceanic crust. If this is true, degree of deformation of serpentinized peridotite from the latter must be clearly low in comparison with that from the former. In addition to the analysis of bathymetric data obtained during the cruise, we have to inspect the idea by the deformation fabrics of serpentinized peridotite.

From evening on December 3, the sea condition become worse caused by strong easterly winds. We were forced to give up dives for four days, and while shifting to the south swath mapping was partly conducted during these days. On December 8, we conducted the last dive (Dive #375) of Leg 1 cruise at the summit area of North Chamorro Seamount. Although we only had two hours for survey due to bad weather condition, we succesfully took 12 rock samples. Most of them are serpentinized peridotites, but one sample of basaltic in composition shows highly sheard block-in-matrix fabrics including pebbles of metamorphic rocks. The rock may be a key to solve the modes of emplacement of high-pressure metamorphic rocks from the depth.

During the KR06-15 Leg 1 cruise, we conducted 7 dives and missed 4 dives because of bad weather condition. We could not conduct dives at initially planned forearc seamounts in central Mariana, Celestial, Peacock, and Bluemoon Seamounts, and are very disapointed in this regard. However, thanks to this cruise, our data on Mariana forearc seamounts increased markedly. As demonstrated in the section "Shore base study", based on many data obtained during KR06-15 cruise, we strongly believe that we are sure to make great progress on morphological, petrological, and geochemical aspects of Mariana forearc tectonics.

II. General background and objectives

Dredging and drilling in the circum-Pacific regions have revealed that the serpentinized peridotites are often exposed in the nonaccretionary convergent plate margins (e.g. Fisher and Engel, 1969; Hawkins et al., 1972; Bloomer and Fisher, 1987; Ogawa et al., 1985a; Ogawa et al., 1985b; Honza and Kagami, 1977; IGCP Working Group, 1977; Fryer et al., 1985; Ishii, 1985; Fryer, 1996, Fryer and Fryer, 1987). In the Izu-Bonin (=Ogasawara) and Mariana forearcs, enormous amounts of serpentinized peridotite have been raised from the mantle wedge to the seafloor to form a zone of seamounts (Fryer et al., 1985) (Fig. II-1). Fryer et al. (1990) described the fluids seeping from the chimneys at the summit of one of the seamounts (Conical Seamount), and indicated that the fluids were derived from the dehydration process of descending slab.

Ultramafic rocks obtained from the serpentinite seamounts are mainly harzburgite with subordinate dunite, which are more depleted than the abyssal peridotites from the mid-oceanic ridge (Ishii et al., 1992). They were often highly tectonized. Common occurrences of kink band in olivine and pyroxene crystals provide evidence of penetrative deformation. All of them are serpentinized to some degree. Serpentine minerals are antigorite, chrysotile and lizardite (Saboda et al., 1992; D'Antonio and Kristensen, 2004). In addition to these minerals, serpentinized peridotites often contain brucite, and rarely contains minor amounts of acicular diopside and tremolite. Antigorite commonly associate with brucite. Two types of serpentine mineral association are recognized in serpentinized peridotites; one is antigorite bearing and one is antigorite free. In the rocks with the former association, chrysotile and/or lizardite also occur in vein or matrix as later-stage secondary serpentine minerals. Antigorite is stable to higher temperatures than chrysotile (Iishi and Saito, 1973; Evans et al., 1976), and stable association of antigorite and brucite gave stability range of 300˚C~450˚C (Evans et al., 1976). Lizardite favours low temperature condition of less than 300˚C, and is considered to have the same P-T stability field as chrysotile (Peacock, 1987). The high-temperature antigorite-bearing assemblages are only found in the serpentinites from Conical and South Chamorro Seamounts, which are situated in the forearc areas 80-90 km west to the trench. The distances indicate that these two seamounts are located at the most far-off places from the trench in all the forearc serpentinite seamounts, suggesting the possibility that the serpentinites of these seamounts were originated from the high-temperature

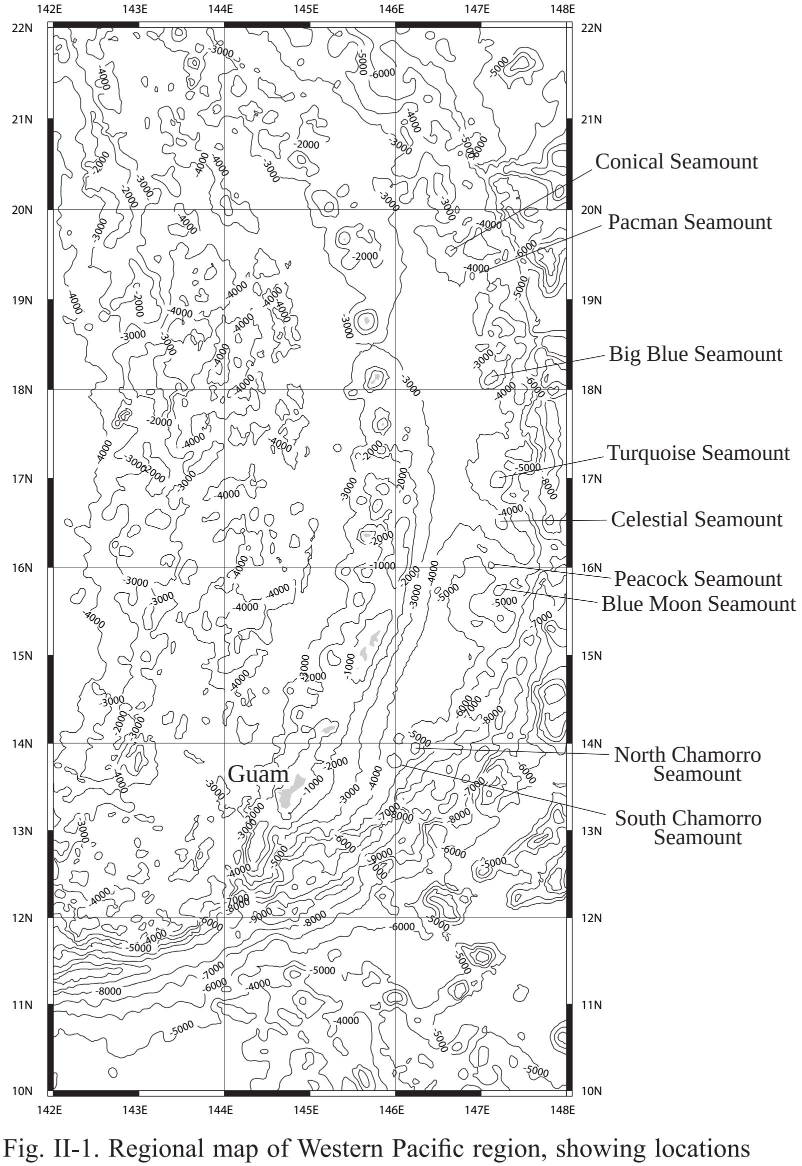

Fig. II-1. Regional map of Western Pacific region, showing locations of forearc seamounts.

deeper part of subduction zone than those of other seamounts situated near the trench. One of our aims of this cruise is to examine mineral assemblages of serpentinites from the many seamounts as much as possible, to establish the distributions of above two serpentine mineral assemblages in the forearc area, and to clarify the origin and process of serpentinization in the subduction zone. We believe that the results obtained this study could be important to proceed the scismological study around the subduction zone.

During Ocean Drilling Program Leg 125, small clasts of high-pressure/low-temperature blueschist facies metabasites were recovered from Conical seamount. It suggests the blueschist facies metamorphism beneath the forearc (Maekawa et al., 1992 and 1993). Recent discoveries of blueschist-facies rocks and sediments including fragments of blueschist-facies minerals from other seamounts suggests that the blueschist-facies rocks must be common in the Izu-Bonin and Mariana forearc seamounts (Maekawa, 1995; Maekawa et al., 2004). To understand the behavior of slab-derived fluids during serpentinization and metamorphism is important because the fluids must be one of the main controlling factors of physical properties of subduction zone materials, which could affect the modes of material transport and earthquakes within the subduction zone. Metamorphic rock clasts recovered from Hole 778A and 779B at Conical seamount provide essential information on interaction between forearc materials and water. Geochemical study of the 778A metabasites indicates that the rocks have chemical affinity with mid-ocean ridge basalts, some of which have zigzag REE patterns due to intense interaction with seawater. These MORB-type rocks probably have originated from trapped oceanic crust in the Mariana forearc when the subduction of the Pacific plate started. The trapped oceanic crust has been tectonically eroded by the subducting slab, contaminated with seawater, and dragged into depth, where blueschist facies metamorphism has prevailed. The Hole 778A metabasites commonly contain quartz veins, which have been produced prior to or during blueschist facies metamorphism because high-pressure minerals, lawsonite, pumpellyite, and aragonite were often crystallized in the vein. When the trapped oceanic crust has been eroded by the subducting slab, the fragmented oceanic crust had encountered the pelagic sediments at the top of the subducting slab. The Si-rich fluids having permeated the Hole 778A rocks were probably derived from pelagic sediments on top of the subducting slab.

A metasomatic rock clast rich in phengite and chlorite was obtained from Hole 779B (125-799B-01R-06, 19-22) at Conical Seamount (Maekawa et al., 2001), and abundant tremolite-chlorite schists were reported from South Chamorro Seamount during ODP 195 (Shipboard Scientific Party, 2002). Rocks with similar mineral associations and similar geochemical characteristics are often found in metasomatic reaction zone developed at the boundary between serpentinite and pelitic schist in the high-pressure Sanbagawa metamorphic belt, Japan. The clast may have

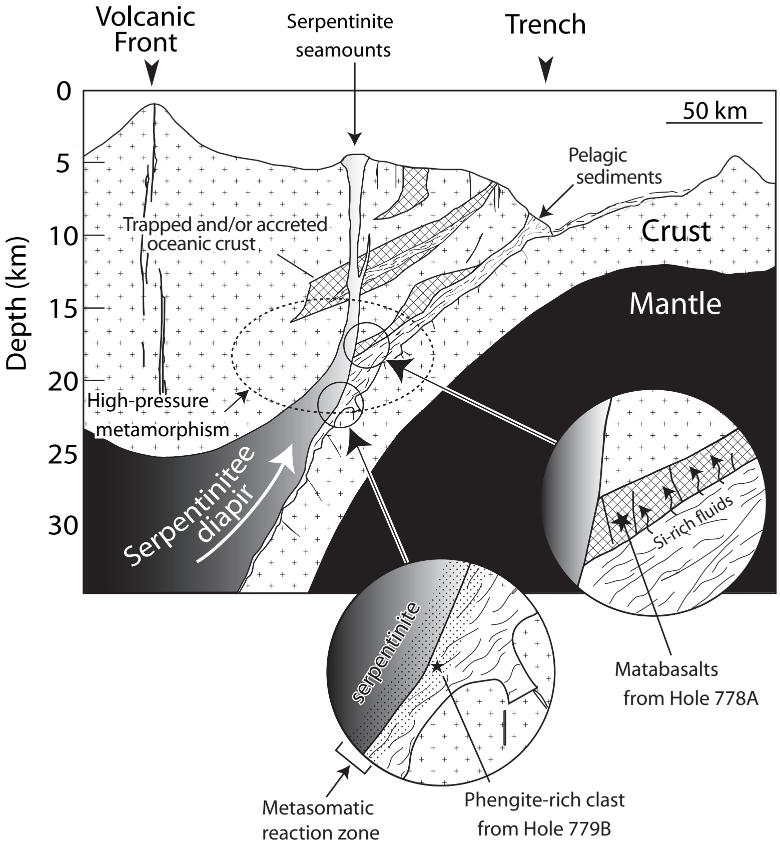

Fig. II-2. Schematic cross section of Mariana trench-arc system, showing formation processes of metamorphic and metasomatic rocks alsong the subduction boundary.

been formed at the boundary between hanging-wall peridotite and subducting oceanic crust where the hydrothermal metasomatic reactions have pervasively occurred (Maekawa et al., 2001 and 2004)(Fig. 2). We wish to establish the general ideas of metamorphism and metasomatism along and above the subduction boundary by examining these rocks obtained during this cruise.

Further more, we will make effort to clarify the modes of occurrence (= morphological features) of the forearc seamounts, petrological and geochemical characteristics of serpentinized peridotite, metamorphic rocks, and metasomatic rocks occupying the seamounts, and consider the phisico-chemical conditions below the forearc and the behavior of water squeezed from the subducting slab in the formation of serpentinite seamounts.

Morphology of the Mariana forearc – A brief review –

Written by K. Fujioka and H. Yokose

Along the Mariana forearc many serpentine seamounts were discovered for the first time during the Kana Keoki cruise in 1981 (Fryer, 1984). Before ODP drilling pre-site survey was carried out for deep-tow, submersible Alvin dive as well as multi-channel seismic profile (Fryer, Pearce, Stokking, 1989). 5 drill holes were spudded in the Mariana Serpentine Seamount Conical Seamount (Hole 778-780) and Izu Torishima seamount (783 and 784) during ODP Leg 125 (1989), and in the Chamorro Seamount (Hole 1200, A-E) during ODP Leg 195 (2001).The results gave us the stratigraphic and petrologic insights, but the recoveries of the cores were so poor that origin and evolution of the serpentine seamount remain unsolved.

The morphology of serpentine seamount was summarized by Fryer et al. (1998) during several cruises. They recognized several seamounts from north to south, Conical, Pacman, Big Blue, Celestial, Peocock, Blue Moon, North Chamorro and south Chamorro, respectively. They also named four more other SS (=serpentine or serpentinite seamount) other than the above, called Ms Pacman, Quaker, Blue Eye and Deep Blue, that correlate to the three big SS south of Pacman from north to south and SS between Celestial and South Chamorro. Fryer described chimney and cold seep at the Quaker and Pacman (Cerulean Spring).Fryer et al. (1999) described serpentine seamount and discussed the origin of the SS. They demonstrated that the SS was formed by the hydration and serpentinization of wedge upper mantle then buoyant uplift by their density difference to make serpentine seamount. High pressure and low temperature metamorphic rocks were transported by this process. Fryer et al. (2000) described each SS using the sss data and proposed fault drived uplift and transportation of serpentine mud and the lateral variation of high pressure blueschist facies metamorphic rocks by the depth of the subducting Pacific slab. Stern and Smoot (1998) summarize the tectonic resume of the Mariana forearc including forearc basin and serpentine seamounts by the side scan sonar data of this region. They recognize the major tectonic difference, oblique and normal subduction of the Pacific Plate.

Fujioka et al. (2003) proposed a new biosphere “Serpentine Biosphere” along the Mariana forearc and suggest way how to estimate the lower limit of the subcrustal biosphere by the elaborated study of microbiological method. Fujioka et al. (2003) conducted the bathymetric survey on the forearc serpentine seamount and made a brief summary of the SS (Onboard report of YK03-11 cruise). They described morphological features of each SS with dive results.

Other than these studies Jonson et al. (1991) reported the existence of allochthonons such as the Cretaceous chert, foraminifers and volcanic rocks that were accreted at the trench lower slope by the subduction of the Pacific Plate.

Therefore as for the origin and development of the Mariana Forearc Serpentine Seamount still remain unsolved even though almost 50 years had passed with many cruises since 1948 when Hess (1948) first pointed out the origin of the Mariana Arc system.

Mariana forearc cold seep geochemistry

written by H. Chiba

Large serpentine seamounts were discovered in the Mariana forearc by Fryer et al. (1985, 1995, 2000). Cold springs were first discovered on the seamounts in 1987 from the manned submersible *Alvin*, near the summit of Conical Seamount (Fryer et al., 1990). These springs had formed chimneys up to 3.5m high composed of aragonite, calcite, and amorphous Mg-silicate, which were lightly covered by bacterial mats and small limpets and gastropods. When one chimney was disturbed by sampling, it began to emit a slow flow of cold water, near the 1.5ºC temperature of the ambient bottom seawater, with pH 9.3 and elevated dissolved carbonate, methane, sulfate, and reduced sulfur relative to the ambient seawater.

Low-salinity pore water upwelling through serpentinite mud at the summit of Conical Seamount was sampled at Ocean Drilling Program (ODP) Site 780 in 1989 (Fryer et al., 1992). It had less than half the chloride and bromide content of seawater and pH of 12.6. Relative to seawater it had higher to much higher sulfate, dissolved carbonate, light hydrocarbons, ammonia, Na/Cl, K, Rb, B,δ^{18}O, and δD; and low to much lower Mg, Ca, Sr, Li, Si, phosphate, and Sr isotopic ratio (Mottl, 1992; Mottl et al, 2003). Dissolved sulfide of 2 mmol/kg was measured in one sample from 3m below the seafloor (mbsf). Near-surface gradients in chloride indicated that this water was upwelling at seepage velocities of 1 to 10 cm/y relative to the serpentine matrix (Mottl, 1992).

Another cold springs were discovered on the summit of South Chamorro Seamount in 1996 (Fryer and Mottl, 1997). Divers in the manned submersible Shinkai-6500 (Dive 351) found three cold springs that were populated by an abundant biota of mussels, small tubeworms, whelks, and galatheid crabs. Carbonate crusts and small chimneys up to 0.3m high were also found, although no venting could be seen. Three push cores were collected at the springs that yielded pore water reflective of their composition.

A series of holes was drilled near one of these springs as ODP site 1200 in 2001 (Shipboard Party, 2002). Except for its higher chlorinity, the upwelling pore water recovered form serpentine on South Chamorro Seamount is remarkably similar to that from Conical Seamount and is upwelling at a similar speed (Mottl et al, 2003). Depth profiles of pore-water composition clarified the cause of the high dissolved sulfide found earlier at shallow depth at Conical Seamount: as documented at South Chamorro Seamount, a microbial community dominated overwhelmingly by Archaea is oxidizing methane and reducing sulfate from the deep upwelling water as well as from seawater, at pH 12.5, producing measured concentration of dissolved sulfide as high as 20 mmole/kg.

In 1997, Univ. Hawaii group conducted a cruise by R/V Thomas G. Thompson to visit 9 mud volcanoes in the Mariana forearc using combination of gravity coring, piston coring, and push coring using the ROV Jason (Fryer et al., 1999). I am not sure whether the analytical results of these samples and their implications have been published or not now onboard. As far as I know, Mottl tried to estimate the fluid composition of deep origin by removing the shallow alteration effect on the fluid chemistry because none of push, gravity, and piston cores was long enough to get the direct information about the fluid of deep origin.

From March to April in 2003, Univ. Hawaii group again conducted a cruise by R/V Thomas G. Thompson with DSL 120 side-scan sonar and Jason II. What they did during this cruise can be seen at the web site of Univ. Hawaii.

During the YK03-07 cruise by R/V Yokosuka and Shinkai-6K, five MBARI cores were sampled for pore-water analyses. They were sampled at South Chamorro, Celestial, and Big Blue Seamount. Only the 20 cm core sampled at the flat mud close to #75 marker at South Chamorro Seamount (Dive #779) showed the symptoms for the upwelling of deep fluid by depth profile of pH and alkalinity. The analyses of these samples had been done already and the results will be discussed with the results of the sample obtained in this cruise.

III. Explanatory note

The R/V “KAIREl”

Modified by K.Fujioka from the manuscript originally written by K.Fujioka, T.Kodera, T.Ishii, K.Okino, T.Motoo and K.Kawamura

Integrated research vessel exploring the ridges and trenches

The deep sea research vessel “KAIREl” is designed to survey deep sea floor and sub-seafloor structures of arc-trench-backarc systems, ridge systems and basic oceanic crustal structure. R/V “KAIREI” is the exclusive mother ship for the 7,000m class remotely operated vehicle “KAIKO” (meaning "trench") which entered service in 1995 and “KAIKO 7000II” in 2006. In addition, R/V “KAIREl” is equipped with modern geophysical and geological instruments such as a 204 channel seismic profiler to map detailed structures of subduction zones, piston core and dredge samplers for studying the nature of the deep sea bottom surface layers, faults and other geological and geophysical features. The R/V “KAIREl” is available for integrated research projects on ridges and trenches, and all the other sea floor areas of the world.

1) Equipment installed in “KAIREl”

The equipment of R/V “KAIREl” has been specifically selected to fulfill the above mentioned scientific objectives. The major instruments are a multi-narrow beam batymetric mapping system (Sea Beam 2112), and integrated sub-bottom profiler (see chapt. 3-2), gravity meter (See chapt. 3-3.), proton magnetometer (See chapt.3-4.) and three component magnetometer (See chapt. 3-5.), and various kinds of sampling devices such as piston corer and dredge. These equipment will be described in the following chapter. There are several onboard laboratories for data recording, and data and sample analysis. These are the Research Room, Mission control & Computer Room, Wet laboratory (chemistry and biology), Dry laboratory (Geophysics), Gravimeter room, Kaiko Operation’s Center, Rocks and sediment laboratory, Library, Video Room and Personal computer Room. The ship also has an aft wheel house which overlooks the entire aft operations deck for the operation of the ship, winches, A-frame and cranes during station work such as dredge hauls, piston coring and sampling, launch and recovery operations. The following are brief descriptions of the major laboratories aboard R/V “KAIREI”.

Research Room

The research room was designed as a large multi-purpose space for such activities as meetings and lectures for the aboard scientists, a study and analysis room for scientists and also for the science and operations can meetings between scientists and ship’s crew. It contains two big tables which can connected to make one huge table for large meetings. There is a terminal of ship’s Local Area Network (LAN) for processing and calculation of Sea Beam and sub-bottom profiler data, a large printer to output the maps, and a light box to trace these maps and to draw figures. A white board, which is capable of producing copies, and a plasma television for multiple projectors are also available. The research room also contains a map desks and copy machine.

Wet laboratory (chemistry and biology)

This room is located just forward of the aft working deck on the upper deck level was designed for processing and analysis mainly of chemistry and biology samples. The equipment installed in this room include a draft chamber for chemical work, a freezer and refrigerator to keep biological and sediment core samples and chemical reagents, binocular and petrographic microscopes for the observation of smear slides and handspeciments, pure water and milli-Q water systems for the chemical and biological use. The sink is made of polyvinyl chloride for resistance to chemicals.

Mission control and Computer Room

This room is located on the bridge deck, just behind the wheel house. This room was designed for the operation of the ROV “KAIKO” and now “Kaiko7000II” and Sea Beam system.
The “Kaiko7000II” operation panel and related acoustic navigation system for positioning “Kaiko7000II” in located here. “Kaiko7000II” operators and scientists have operational control seats in front of operation panel, from which they control operations and observe the sea floor through various video cameras.

The Sea Beam system equipment in this space includes two main electronic cabinets, Sub-bottom profiler electronics, and three UNIX WS (SGI Indy) for operations and data monitoring. All the operations except the data processing are done here. Other related equipment (e.g. PC and graphics recorder for the Sub-bottom profiler and side Scan sonar sub-systems) is also placed here.

Mission Control also includes a PC for recording XBT measurement of the measurement of the vertical sea water temperature profiles and satellite receiver/computer combination for receiving meteorological satellite data. Two HP UNIX WS are also located here and function as the network server, and shipboard LAN (Local Area Network).

Dry laboratory (Geophysics)

The dry laboratory, located on the deck level, was designed for geophysical operations, data recording, processing and analysis. Data loggers and PCs for magnetic data recording and monitoring are located here. Two UNIX WS (SUN sparc and HP) are for processing and analysis of geophysical data.

All multi-channel seismic (MCS) operations, data recording and processing are carried out in the Dry laboratory. The equipment for these operations consists of several computer, data loggers and operational monitoring and control equipment, including for navigation control and monitoring, air-gun and streamer cable control and monitoring, data processing and recording. Some post-collection processing steps can be carried out aboard ship, such as initial data stacking.

Gravimeter room

The marine gravity meter system KSS31 (Bodenseeweek) is installed in this room. The system consists of three main subsystems, gravity sensor and stabilization, and data handling subsystems. The vertical reference unit of the three-axis fluxgate magnetometer is also installed in this room.

Rocks and sediment laboratory

This laboratory is developed to processing and analysis of both rocks and sedimentary samples. It contains a rock cutting saw and a polishing machine for the rocks so that fresh samples can be obtained within the vessel. Even manganese encrusted, sediment coated and weathered surfaces of the dredged rock fragments lithologic descriptions can be made. Polished rock thin sections for microscope observation can be made using the grinding and polishing machines in this room.

Extruded sediment cores from piston core-tubes (80 mm in diameter, and up to 20 m long) are divided into 100 cm long segments and MBARI type core tubes and filed in lab core storage shelves. Each segment of cores is split into Working and Archive halves on the core observation table. Close-up photographs are taken of each Working half employing a special core photo stand. Samplings for various investigations are then made. Archive halves cores are stored in the large sample refrigerator, having many core storage shelves.

Library

Various kind of reports , books and other information are gathered in the library for the convenience of every scientist. They are onboard cruise reports of the JAMSTEC Fleet, GSJ reports, JHD reports and ORI ‘s report, books and research papers concerning marine geology and geophysics.

Personal computer room

The personal computer room is located on the main deck. There are three Macintosh computers (Power Macintosh 9500/200) and two Windows machines (FMV-Desk power) in this room, along with a digital scanner and network printer. Shipboard scientist and crew use these facilities to write reports, compile logs and for any computing needs. All the computers in this room were connected with the shipboard network system (LAN) Therefore, scientists can transfer data and messages between shipboard stations and to land via e-mail.

2) Research activities that “KAIREl” engages in

1. Operation of the Remotely Operated Vehicle “KAIKO”

The remotely operated vehicle “KAIKO”, which successfully dived to the Challenger Deep (10,911 m deep) of the Mariana Trench in March 1995, is carried to and from dive sites aboard the support vessel “KAIREI”. Those operators at the “Kaiko7000II” Control Platform control the ROV’s underwater operations through remote controls and monitors by operation team.

2. Exploration of the Interior of Crustal Structures

The 120 channel seismic profiler aboard "KAIREI" is a seismic reflection system in which acoustic waves generated by air guns penetrate sub-seafloor sedimentary and igneous strata. The reflected waves are then detected by the towed streamer cable and recorded aboard ship. By analyzing the recorded data, crustal velocities and thickness are obtained in detail, to depths of more than 10 kilometers below the sea floor.

3. Seafloor bathymetry and sediment distribution

The multi-narrow beam echo sounder, capable of sounding the sea floor to depths of 11,000m, produces wide area precision sea bottom bathymetric maps in real time. The sub-bottom profiler sub-system, operated simultaneously, gives geological information about the sea floor, including faults, igneous and sedimentary rock distribution.

4. Reduction of Underwater Noise

Measures have been taken to minimize ship noise radiated into the sea water from the ship's hull so that "KAIREl" 's many underwater acoustic systems have improved signal to noise ratios.

3) Ridges and Trenches of the world

Ridges occupy the tectonic plate boundaries where plate growth is occurring. The total length of mid-ocean ridges is almost 60,000 km, along which active magmatism, crustal accretion and shallow earthquakes are ongoing occurrences. On the other hand, Deep-sea trenches and subduction zones mark plates converge and one plate descends beneath the edge of another plate, causing numerous and major earthquakes. It has been recognized as important that the dynamics and processes taking place at ridges and trenches should be correctly understood. This is particularly true and urgent in Japan, a country visited by disastrous earthquakes caused by subduction of the Pacific and Philippine Sea Plates beneath the Japanese Islands. We thus consider extensive investigations of these areas to be a major scientific priority.

The JAMSTEC operates the "KAIREl" and ROV "KAIKO 7000II" in close coordination with operations of manned research submersibles "SHINKAI 6500" and other marine science tools. With the aim to extensively investigate the trenches of the world, such as the Mariana, the Peru-Chile, the Palau, and the Yap Trenches, in addition to those around Japan whose studies have already begun.

The ROV KAIKO 7000II

KAIKO system is originally the 10,000m class deep sea Remotely Operated Vehicle (ds-ROV) which has been developed for use in deep sea research that has not been possible by the existing manned submersibles for resons of ocean depth or sea floor topographies. The system will also be used for pre-site surveys and rescue for the manned submersible SHINKAI 6500. After the KAIKO vehicle had been missed in 2003, “KAIKO 7000” consisting of the previous KAIKO’s launcher and remodeled 7000m-class deep sea vehicle ROV “UROV7K” was constructed. In 2006, new 7000-m class deep sea vehicle was produced by KAIKO team, and “KAIKO 7000II” started scientific deep sea observations.

The sysytem consists of two under water robots (called Launcher and Vehicle), cables, cable handling systems and a positioning system (Mikagawa et al., 1999, 2000). KAIKO 7000II is a dual ROV system, with Launcher serving as a wide area survey vehicle linked to Vehicle, which that functions as a precision multi-sensory imaging and sampling platform (descriptions are listed in Tables III-1). Launcher is designed to carry out two types of missions. One is as a launch base for Vehicle and the other is as a stand alone towed vehicle system. Launcher is equipped secondary cable handling system and acoustic apparatus (Side Scan Sonar and Sub Bottom Profiler).

	Launcher	Vehicle
Length	5.2 m	3.0 m
Width	2.6 m	2.0 m
Height	3.2 m	2.1 m
Weight in the air	5.3 t	3.5 t
Maximum operation depth	11,000 m	7,000 m
Payload	-	Less than 50 kg
Towing speed	Less than 1.5 knot	
Observation equipments	CTD(1) Side scan sonar (1) Sub-botom profiler (1) Black-and-white TV camera for general monitoring (1) Black-and white TV camera for monitoring secondary cable (1)	CTD(1) Wide-angle color TV camera (2) 3CCD color TV camera (1) 5-mega pixel digital Still camera (1) Lighting Navigation devices
Navigation equipments	Sonar for investigating obstacles forward (1)	Black-and-white TV camera Altimeter, Depth recorder, Compass Emergency flasher Sonar for investigating obstacles forward GPS radio, ARGOS transmitter
Work Devices	-	Manipulators (degree of freedom 6, 1 units)
Cables	Fiberoptic electromechanical cable Main cable (45 mm x 12,000m) Secondary cable (29.5 mm x 250 m)	

Table III-1. System specification of KAIKO 7000II.

SEA BEAM 2112

Modified by H. Yokose, Y. Fujimoto, H. Sato, M. Takaesu, and K. Fujioka,
(originally written by K. Okino, T. Kodera and M. Takahashi)

SEA BEAM Survey

The SEA BEAM 2100 multibeam sonar seafloor mapping system was run every night from November 28 to December 9. Dedicated survey took place every night for 12 to 14 hours, roughly 1700 to 0500 or 0700 depending of the dive site location. The bathymetry data represents 120 data points per sonar ping, while the sidescan data contains 2000 pixels per ping. The swath was fixed at 60 degrees, so a typical swath width for these depths (3000-5000m) was 10 km. Both the bathymetry and sidescan data are included in the same binary SEA BEAM file. Typical survey speeds ranged from 9-10 knots, depending on sea conditions and other survey requirements. The R/V technical staff preformed the initial processing and gridding of the SEABEAM data.

Products from the SEA BEAM system include standard contour maps, artificially illuminated bathymetry showing texture, beam amplitude, and sidescan data. The sidescan data is better at distinguishing between bare rock and sedimented areas, as well as highlighting small blocks, structural trends, fault scarps, and other steep slopes. These products were used daily for the planning of ROV Kaiko 7000 II dives.

Outline of the system

Bathymetric data were collected by the SEA BEAM 2112 (Sea Beam Instruments). The SEA BEAM 2112 is a multi-beam survey system that generates data for and produces wide-swath contour maps and side scan images. It transmits a sonar signal from projectors mounted along the keel of the ship. The sonar signal travels through the sea water to the sea floor and is reflected off the bottom. Hydrophones mounted across the bottom of the ship receive the reflected sonar signals. The system electronics process the signals, and based on the travel time of the received signals as well as signal intensity, calculate the bottom depth and other characteristics such as S/N ratio for echoes received across the swath. Positioning of depths on the seafloor is based on GPS and ship motion input. The data is stored to the hard disk ever 6Mb. Plotters and side scan graphic recorder are also included with system for data recording and display.

The hardware system consists of two main subsystems, transmitter and receiver respectively. The basic 12 kHz projector array is a 14-foot long linear array positioned fore and aft along the ship's keel. It forms a downward projected acoustic beam whose maximum response is in a plane perpendicular to its axis. The beam angle is narrow, 2º in the fore/aft direction. The receiver array detects and processes the returning echoes through stabilized multiple narrow athwartship beams in a fan shape. The hydrophone array has a flat shape in the case of R/V KAIREI, although the standard SEA BEAM 2000 series system has a V-shaped array. The system synthesizes 2º × 2º narrow beams at the interval of 1º, and the swath width varies from 120º at depths from 1500 m to 4500 m, 100º from 4500 m to 8500 m and 90º deeper than 8500 m. The transmit interval of the sonar signal ping increases with water depth, for example about 20 sec. at 6500 m. So, the horizontal resolution of the bathymetry data depends on the depth and ship’s speed. The accuracy of the depth measurement is reported as 0.5 % of the depth.

The software which controls the system is called the SeaView. It employs the Lynx Operating System . Indy Work Stations (SGI) are used for the operation. The obtained raw data includes data records of each ping (bathymetry, side scan image, position) , nautical information and correction parameters such as water velocity structure. Post processing consists of editing data (deletion of bad data, correction of position etc.), making grid data files and various maps. Software used is SeaView and GMT ver. 3.0 (Wessel and Smith, 1995).

Additional notes

One of the important parameters for depth and position accuracy of the bathymetric survey is the sound velocity profile. SEA BEAM 2112 system uses the sound velocity data not only for calculating the depth and position of each beam during the ray tracing process, but also for the beam forming process. The temperature of the surface layer is most important in this regard and the system measures and uses surface temperature in real time. Except for the surface layer temperature, the user must input the temperature profile. During KR06-15 cruise, data from XBT measurements were used to 1830 m. The locations of the XBT measurements are listed in Table xx. For depths greater than 1830 m, previous results of CTD measurements in the same area and the same season were used. The XBT measurement data and velocity profiles used during this cruise are listed in Table III-2 and Figure III-1.

The quality of the obtained bathymetry depends mostly on the sea state. After eliminating bad data, the data are gridded and various maps are produced. The grid size was typically 100-200 m, because the horizontal resolution of the raw data is about 30-150 m depending on the water depth (<1000m to >5000 m). Bathymetric data, including YK03-07 cruise, for all survey lines were processed manually onboard using the MB-System program mbedit. Bathymetric data for all survey lines were processed onboard, on the other hand, the intensity data (side-scan image) were processed only for selected lines.

Sub bottom profiler

Sub bottom profiler data were obtained by using the SEA BEAM 2112.004 Subbottom Profile Subsystem, which is an additional option to the SEA BEAM 2112 Multi-beam Bathymetry System. The capability of the system ranges from 500 m to 11,000 m. Depth penetration varies with bottom composition and may be as much as 75 m. The system uses an array of 60 TR-109 projectors, operating at 4 kHz to form a vertical beam of 45º athwartship and 5º fore/aft. The system startup, parameter setting, and real-time control is performed by Indy Work Station (SGI). The data is displayed on a terminal and EPC recorder, and stored on harddisk and a data logger.

During the KR06-15 cruise, we tried to use the sub bottom profiler, but the data quality was not so good owing to ship’s speed, about 10 knot and topographic roughness, steep slope.

2006/11/27	19º 39.7718N	146º 35.3001E	01:21:35
2006/11/29	18º 35.9305N	146º 58.0293E	21:06:15
2006/12/02	16º 56.9037N	147º 10.0988E	20:59:13

Table III-2. XBT measurements location list.

```
TSK XBT/XCTD-SYSTEM TS-MK130  Tsurumi-Seiki CO.,Ltd    (Ver.1.00)

データパス名 : c:¥MK-130¥data¥
データ名 : BT-013720061127             ディバイス名 : XBT        BATHYプローブ : 231
データナンバ : 0137                    プローブタイプ : T05      BATHY処理器 : 46
日付 : 2006/11/27                      深度係数 a : 6.828
時刻 : 01:21:35                        深度係数 b : -1.82
緯度 : 19-39.7718N                     最大深度(m) : 1830
経度 : 146-35.3001E                    データ数 : 5821           深度ステップ : ALL

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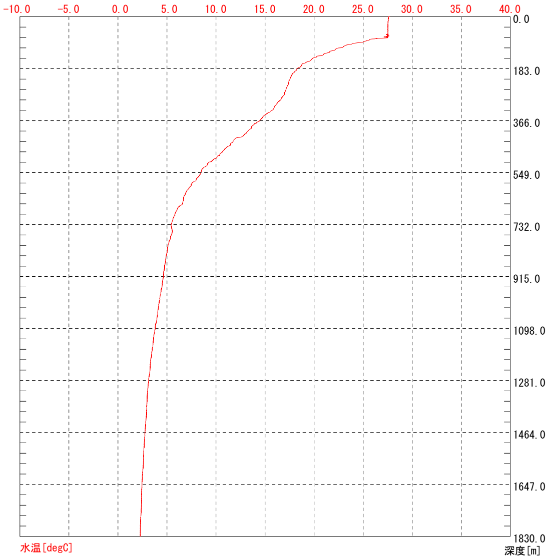

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データナンバ : 0138                    プローブタイプ : T05      BATHY処理器 : 46
日付 : 2006/11/29                      深度係数 a : 6.828
時刻 : 21:06:15                        深度係数 b : -1.82
緯度 : 18-35.9305N                     最大深度(m) : 1830
経度 : 146-58.0293E                    データ数 : 5821           深度ステップ : ALL

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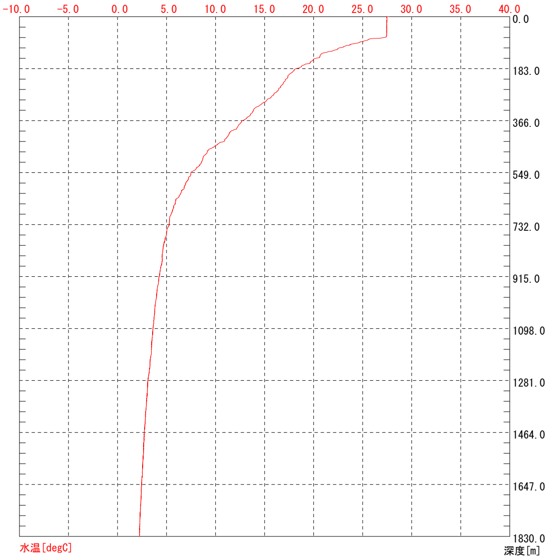

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データナンバ : 0139                    プローブタイプ : T05      BATHY処理器 : 46
日付 : 2006/12/02                      深度係数 a : 6.828
時刻 : 20:59:13                        深度係数 b : -1.82
緯度 : 16-56.9037N                     最大深度(m) : 1830
経度 : 147-10.0988E                    データ数 : 5821           深度ステップ : ALL

TSK XBT/XCTD-SYSTEM TS-MK130 -鉛直分布図印刷-   (Ver.1.00)
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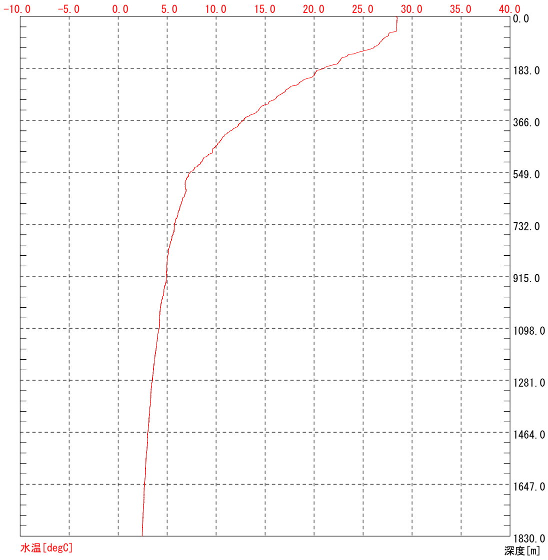


Fig. III-1. XBT Profiles.

Magnetometer

1. Proton precession magnetometer

Modified by K. Fujioka and M. Takaesu form the manuscript originally written by K. Okino et al., 1998

The total magnetic field measurements were collected by the PRTO10 magnetometer (Kawasaki Geological Engineering). The PRTO10 is a proton precession magnetometer, which consists of two main parts, the sensor and the measurement device (Pict.1 and Pict.2). The sensor, towed about 300m behind the ship, detects total magnetic field strength as an electronic signals induced by the precession of the proton. The measurement parameters such as measurement interval, charge time, capacity of condenser etc. are controlled by the measurement device in the dry laboratory. The data are displayed on a personal computer and are stored in the hard disk (total magnetic field data from the proton magnetometer and also (Hx, Hy, Hz) from the three axis magnetometer are stored in the same file).

Magnetic surveys were carried out during the night time from 27th Nov. - 04th Dec. 2006. in the serpentine seamount, Mariana Trench area. The magnetic data were obtained every 30 sec. after 6 sec. charging. The resolution of the data is 0.1 nT. Some measurement parameters were adjusted during the survey, which are listed in Table III-3. The band pass filter is effective to improve the data quality.

On the first survey line in the Mariana Trench area (MRT03), numerous signal counts were missed while the system was being tuned, and the data quality is poor. After adjusting the band-pass filter, the data quality was greatly improved in the other survey lines. We subtracted the earth's regional magnetic field (IGRF95) from the observed total field to obtain the magnetic anomalies. The magnetic anomaly profiles along the survey line are plotted versus time together with the bathymetry and gravity anomalies (see Preliminary Results).

KR06-15	
Measurement interval:	30sec
External Trigger interval:	6sec
Wait time:	150msec
Band Pass Filter:	1600Hz
Capacitance:	363-380nF

Table III-3. Measurement parameters.

Comment: The adjustment of the measurement parameters is very important to obtain high quality data. We check the effect of recording parameter adjustments on a display device which can store only 1.5 hours of data. Therefore, to test parameter adjustments over longer periods, a strip chart recorder is needed.

Fig. III-2. PRTO10 is a proton precession magnetometer.

2. Three axis fluxgate magnetometer

Modified by K. Fujioka and M. Takaes form the manuscript originally written
by Y. Takahashi, T. Kodera and K. Okino

Three components of the magnetic field (Hx, Hy, Hz) were simultaneously measured using the SFG-1214 (Tierra Tecnica). The hardware system consists of four components, as shown in Fig. III-3. The magnetic sensor (fluxgate type) is installed on a tripod on the compass deck. Signals are sent to the recording device in the dry laboratory. The roll and pitch of the ship, detected by the vertical reference unit (VRU) in the gravity meter room, and the navigation information are measured and transmitted to the recording system and combined with the magnetic field measurements. The data are displayed on a personal computer and stored on the hard disk or 3.5 inch MO. The data file includes date, ship's position, roll, pitch, gyro information and the total magnetic force measured by the proton precession magnetometer as well as Hx, Hy, Hz.

The measurement interval is 1/8 second. The resolution of the magnetic measurement is 1 nT. To determine the effect of the ship's magnetization, for subtraction from the natural earth’s field measurements, we carried out figure eight tracks in the north-east ward of “Conical Seamount” as shown in Fig. III-4.

Magnetic measurements were recorded for all survey lines. The data quality looks good. No processing has yet been done.

Fig. III-3. Three axis fluxgate magnetometer.

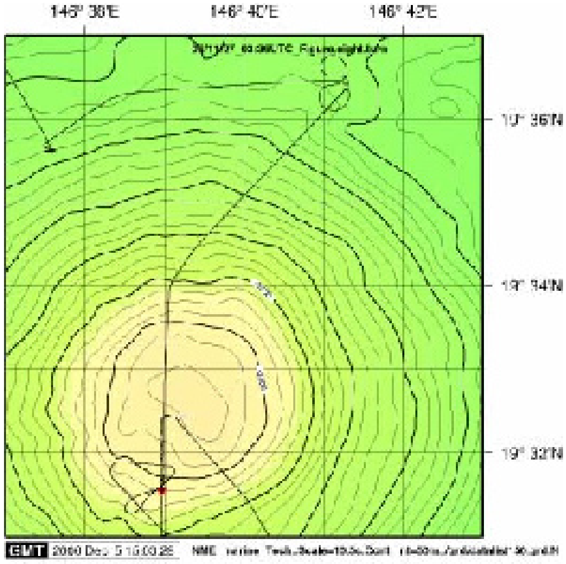


Fig. III-4. Figure eight tracks at the north-east of Conical Seamount.

06/11/27 03:36UTC – 03:47UTC
19º36.5N, 146º41.0E

Gravity meter

Modified by K. Fujioka and M. Takaesu form the manuscript originally written by K. Okino et al. (1998)

The gravity data were collected by the KSS31 marine gravity meter (BODENSEEWERK) that is placed in the gravity meter room on the second deck (Fig. III-5). The system consists of two main components, the gyro-stabilized platform with gravity sensor and the data logging subsystem. The sensor includes the spring-mass assembly as the basic gravity sensor, and the control electronics. Measurements are transmitted to the logging system and are stored in the hard disk.

The gravity data were recorded every 1 minute through the geophysical survey. The accuracy of the measurements is 0.5 mgal. The data file includes Etovos corrected gravity, free air gravity anomaly and simple Bouguer anomaly as well as measured gravity. The shipboard gravity meter was calibrated to the absolute gravity measurement at the JAMSTEC pier as follows,

Date	place	shipboard gravity	absolute at benchmark
06/11/23 05:13(UTC)	JAMSTEC pier	-1446.58mgal	9799758.933mgal
06/__/__ __:__(UTC)	Apra Harbor	_	_

The system calculates free air anomalies and simple bouguer anomalies using tentative correction value. Therefore, in processing an additional correction is made using the true shipboard gravity reference value as measured at the pier listed above. After this correction, free air anomaly profiles are plotted versus time together with the bathymetry and magnetic anomalies (See Preliminary Results). The data quality is good except for the case of course changes.

Fig. III-5. Gravity meter.

Geochemistry

Written by H. Chiba

Treatment for MBARI core sample for pore water analyses

Seafloor sediments collected by MBARI corer were subsampled into several sections of every 5 cm interval from the holes of the MBARI corer wall by insertion of 28 mmf plastic tubes minimizing air contamination. Sampled sections were transferred into 50ml syringe in which stainless steel mesh and filtering paper was placed for rough filtration. Sediment in the 50ml plastic syringe was squeezed by a handy vice in refrigerator. Squeezed pore water was transferred into 10ml plastic syringe through 3 ways stopcock and 45μm membrane filter. Pore water samples were stored 10ml glass vials. The remaining sediment samples in the MBARI corer were slowly pushed out from the corer into plastic bags by 5cm interval. They are used for further pore water squeezing, if necessary, and the remaining samples were stored in the refrigerator for onboard analyses.

Onboard analyses

Concentrations of aqueous silica and NH_4^+ and pH were measured onboard in this cruise. If the above analyses show the involvement of deep fluid to the squeezed fluid sample, alkalinity was measured too.

pH

pH of fluid sample was measured by Metrhom pH meter with combined glass electrode, which was calibrated against JIS standard buffer solutions of pH=6.88 (20ºC) nad 4.00 (20ºC). Measurements were performed within several hours after completion of squeezing on board.

Dissolved silica (SiO_2(aq))

Dissolved silica was measured by colorimetry of molybdate at wavelength of 812μm. Analytical procedure is as follows:

(1) Take water sample (0.5 ml) in cuvetto, and then add H_2O (0.5 ml), and Molybdate solution (1.0 ml).
(2) After standing for 10 to 20 minutes, add reducing solution (1.5 ml).
(3) Cover the cuvetto with sealon film and shake vigorously and wait for 3 hours.
(4) Absorption was measured at 812 nm.

NH_4-N

NH_4-N in fluid is measured by colorimetry at 640 nm according to the following procedure:

(1) Take fluid sample (0.1 ml) in cuvetto.
(2) Add phenol solution (0.5 ml).
(3) Add nitorprusside solution (0.5 ml).
(4) Add oxidizing solution (0.5 ml).
(5) Wait for at least 1 hour.
(6) Absorption was measured at 640μm.

Alkalinity

Alkalinity of fluid is measured by the Gran titration method according to the following procedure:

(1) Take 10 ml of raw fluid sample in a plastic bottle.
(2) Adjust pH to 3.5 by titration of 0.1M H_2SO_4.
(3) Add 0.005 ml of 0.1M H_2SO_4 and record pH and equilibrium voltage.
(4) Repeat step (3) at least 10 times.

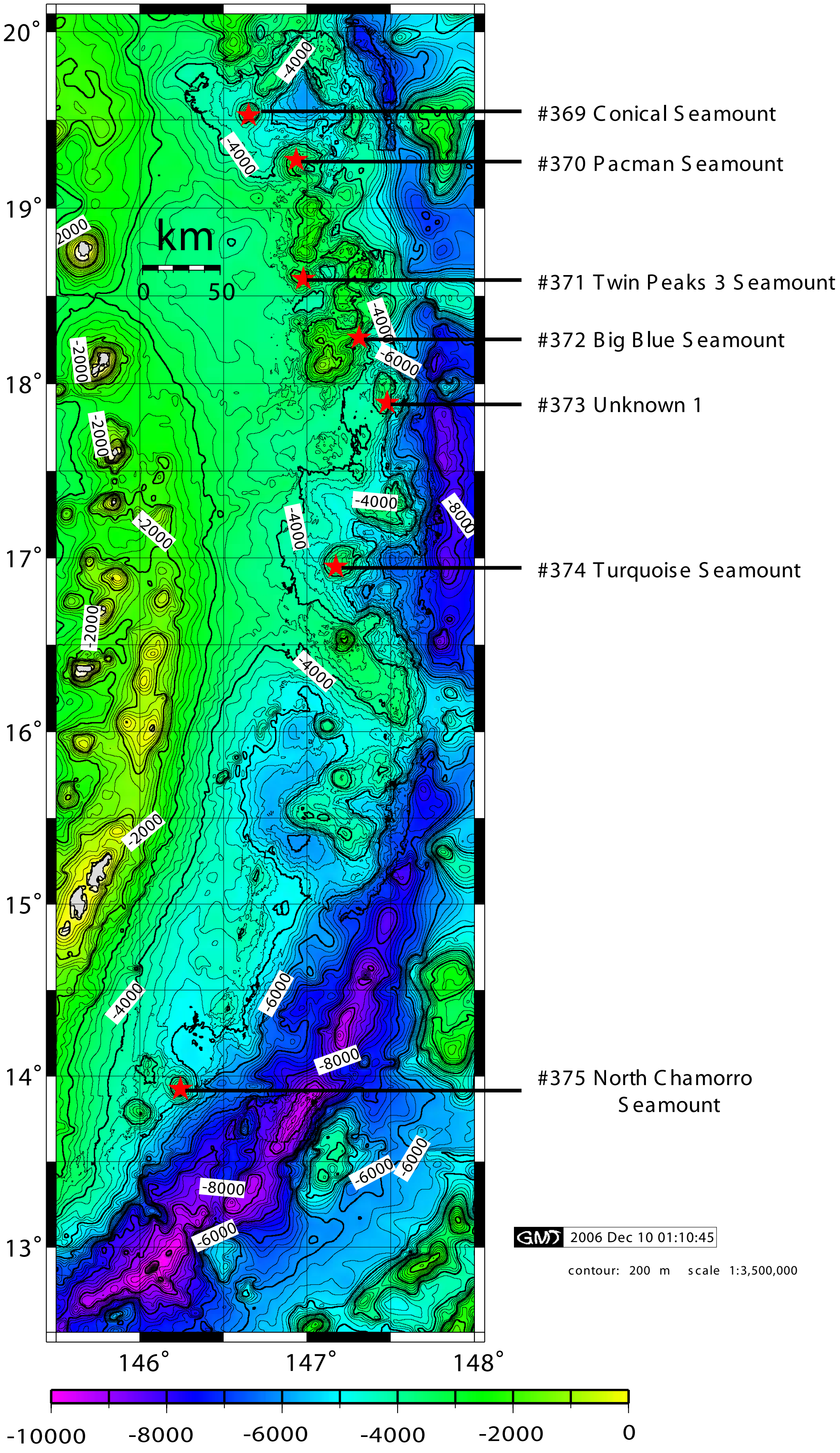
Calculate alkalinity of sample by Gran plot method.

IV. Dive Report

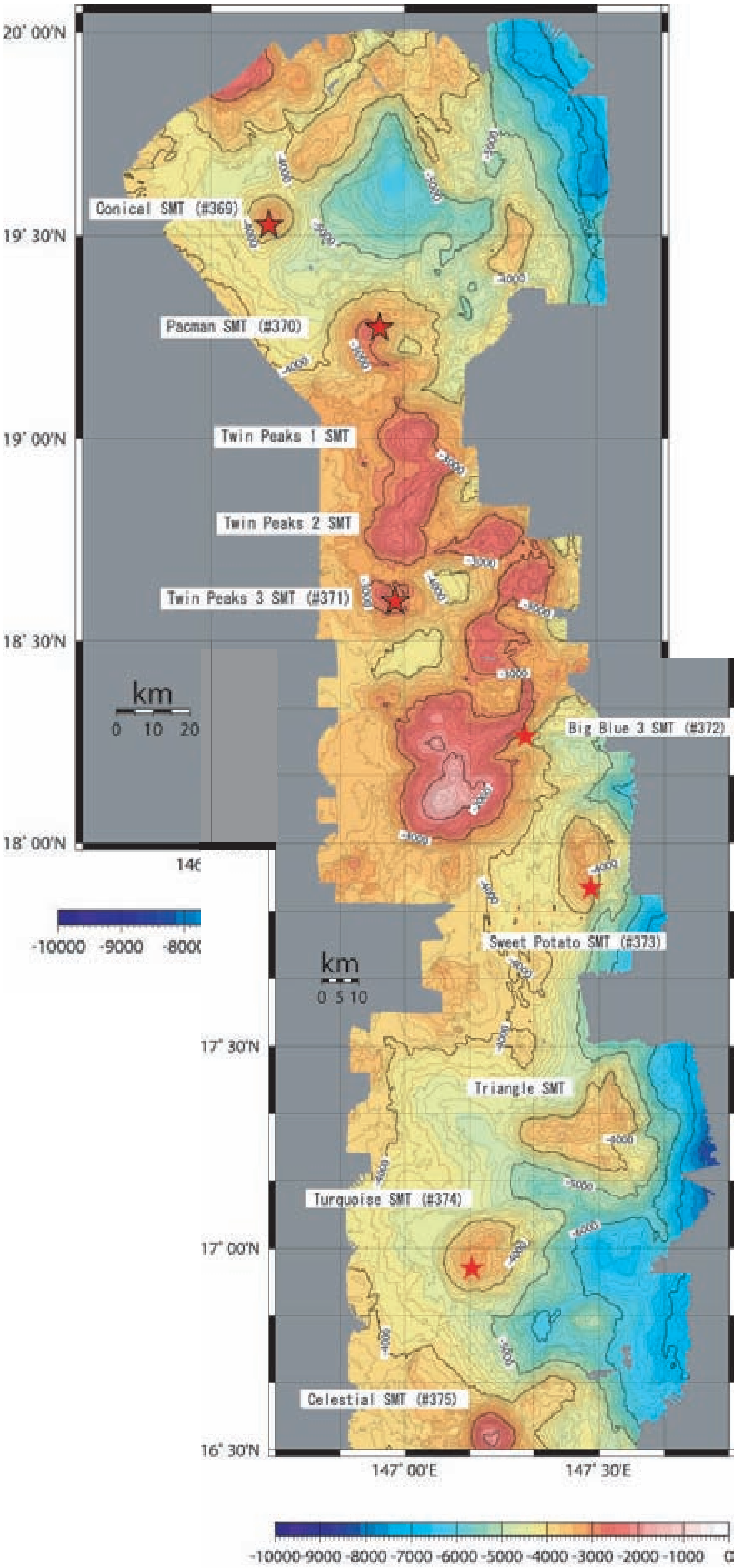
Seven dives were conducted during KR06-15 Leg 1 cruise. Dive list, dive site map, and each dive report are given in this chapeter.

Dive#	Investigater	Main objectives	Site	Datum	Start	Lat.(N)	Lon.(E)	Depth (m)
date	Affiliation			Nav.	End(LCT)			
7K#369	Hitoshi CHIBA	Sampling rocks and pebbles, MBARI cores, and observation at the summit of the seamount	Conical Seamount	WGS-84	12:04	19º31.70' N	146º38.88' E	3085
28th Nov.06	Okayama Univ.			SSBL	14:40	19º32.41' N	146º38.95' E	3121
7K#370	Hirokazu MAEKAWA	Sampling rocks and pebbles, MBARI cores, and observation at the summit of the seamount	Pacman Seamount	WGS-84	10:48	19º16.39’ N	146º56.11’ E	3143
29th Nov.06	Osaka Prefecture Univ.			SSBL	14:52	19º15.44’ N	146º55.77’ E	3036
7K#371	Hirokazu MAEKAWA	Observation of the steep slope showing the cross-cut section of serpentinite seamount	Twin Peaks 3 Seamount	WGS-84	10:50	18º35.90' N	146º58.57' E	2948
30th Nov.06	Osaka Prefecture Univ.			SSBL	14:43	18º35.49' N	146º58.26' E	2632
7K#372	Hisayoshi YOKOSE	Observation of the steep slope showing the cross-cut section of the eastern ridge of the seamount	Big Blue Seamount	WGS-84	10:50	18º15.77'N	147º18.54’E	3498
01th Dec.06	Kumamoto Univ.			SSBL	14:38	18º16.38'N	147º18.23'E	3055
7K#373	Hirokazu Maekawa	Observation of the steep slope showing the cross-cut section of the near-trench seamount	Unknown 1 Seamount	WGS-84	10:48	17º53.38'N	147º28.71’E	3736
02th Dec.06	Osaka Prefecture Univ.			SSBL	14:36	17º53.62'N	147º28.25’E	3305
7K#374	Kantaro FUJIOKA	Making a topographic and geological cross sectional overview of Turquoise Seamoumt at the southern slope.	Turquoise Seamount	WGS-84	10:41	16º56.99’ N	147º10.26’ E	3306
03th Dec.06	JAMSTEC IFREE			SSBL	13:41	16º57.51’ N	147º10.55’ E	3196
7K#375	Koshi YAMAMOTO	Sampling rocks and pebbles, MBARI cores, and observation at the summit of the seamount	North Chamorro Seamount	WGS-84	12:27	13º55.41'N	146º14.55'E	3484
08th Dec.06	Nagoya Univ.			SSBL	14:44	13º55.85’N	146º14.34'E	3449

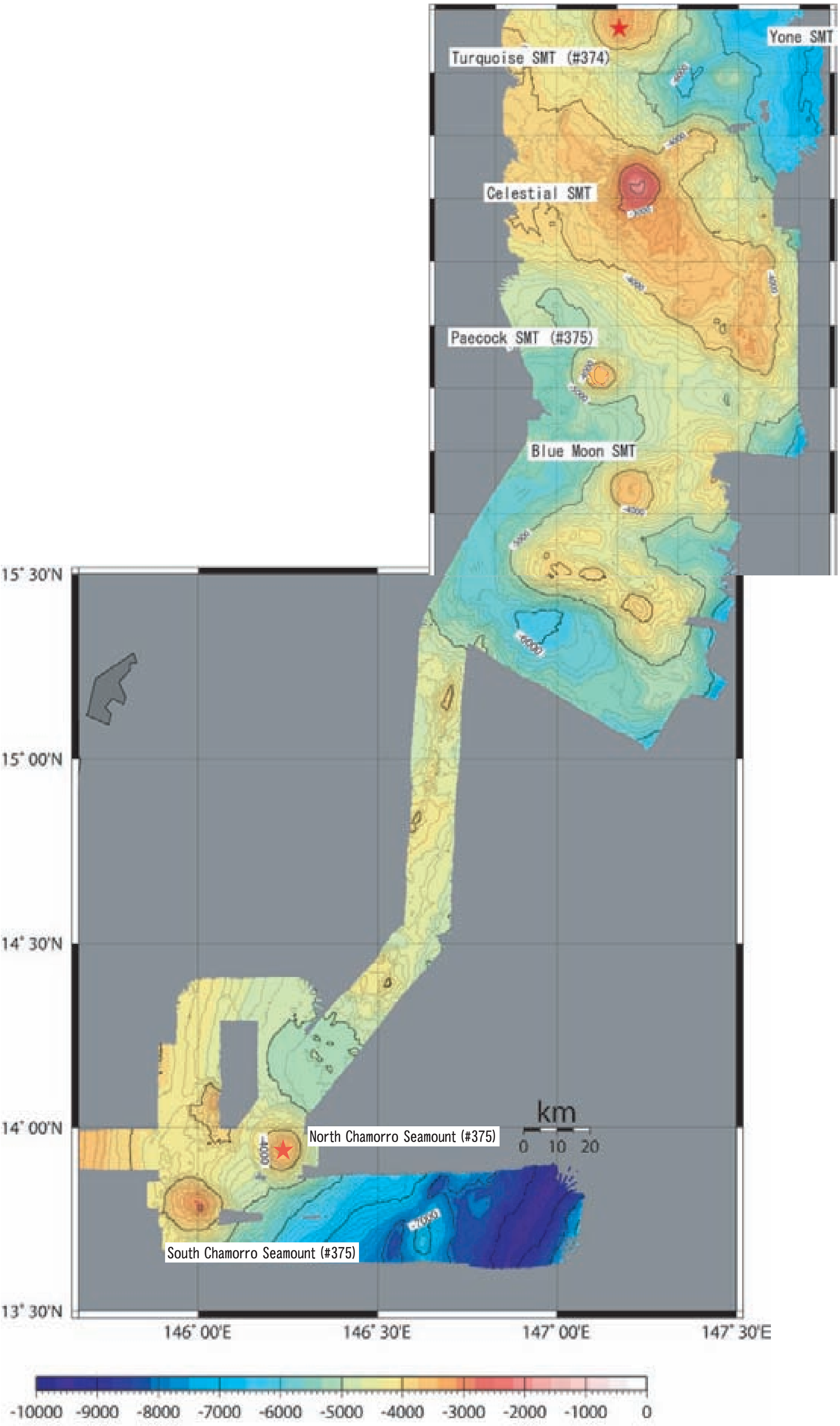
Dive list of KR06-15 Leg 1 cruise.



Bathymetric map showing location of each dive.
Red stars indicate thelocations of dive sites.



Bathymetric map showing location of each dive.
Red stars indicate thelocations of dive sites.



Bathymetric map showing location of each dive.
Red stars indicate thelocations of dive sites.

Dive Report

Preliminary Results of KAIREI 7000II Dive #369				
Dive No.	369	**Date**	2006/11/28	
	Name		**Affiliation**	
English	Hitoshi CHIBA		Okayama University	
Japanese	千葉　仁		**Address**	
Speciality	Geochemistry		3-1-1 Tsushima-naka, Okayama, Okayama 700-8530	
Theme	Geography, Geology, Petrology and Interstitial Water Chemistry of Conical Seamount, Mariana Forearc			
Area	Mariana Trench			
Site	Conical Seamount, Marinana Forearc			
	Latitude	**Longitude**	**Time**	**Depth**
Landing	19º31.70' N	146º38.88' E	12:04	3209 m
Leaving	19º32.41' N	146º38.95' E	14:40	3121 m
Cruising Distance	1300 m	**Deepest Point**	3209 m	
Dive Summary	Landed at the south slope of Conical Seamount, we moved just north to find the Grave Yard, the cold seep field with many carbonate chimneys, and to sample rocks and sediment along the dive course. The surface of the seamount was entirely covered with serpentine mud flow.Rripple mark was observed almost everywhere. At the landing point, we sampled two rocks (serpentinized preridotite and serpentinite). Between the landing and leaving points, many ridges made by serpentine flow were observed. Steep cliffs were observed frequently and show the shallow internal structure of serpentine flow. Old serpentine flow was found to be coated by manganese-oxide. Above about 3150m water depth, carbonate chimneys were found several times. But no active cold seep was observed. At the end of the dive, two MBARI cores were taken near the dead 1m tall chimney. The top of the chimney was sampled by the manipulator and was composed almost entirely calcium carbonate. One rock sample (serpentinized preridotite) was taken nearby the chimney. We, unfortunately, could not reach the center of the Grave yard and probably passed the western edge of the area.			
Apparatus	MBARI corer short(30cm) x 3, long(50cm) x 2, rake			
Visual Records	TV1, TV2, TV3, Digital Still Camera 277			
Samples	Rocks 3, Cores: short 2, long 1, Chimney 1 Total 7			
Key Words	Conical Seamount, cold seep, sediment, serpentine flow, carbonate chimney			

Principal Investigater: Hitoshi CHIBA Dive#369

Preliminary Results of KAIREI 7000II Dive #369

Summary of Results (For press)

Please write main three results of this dive.

1) Observation of serpentine flow ridge and cliff showing the structure of shallow part of the serpentine flow deposit.

2) Sampling of a dead carbonate chimney.

3) MBARI sampling near the sampled chimney.

1)Observation of serpentine flow ridge and cliff showing the structure of shallow part of the serpentine flow deposit.

Ridges of a few meters high were observed frequently during the dive. The ridge consists of fine serpentine mud and boulders. The cliffs of a few meters high were also observed frequently. At least four layers were observed at the cliff of 3meters high. Top layer look likes brown at TV3 and consists of fine particles, probably calcareous ooze. The second layer contains white matrix and boulders, the serpentine mud flow. The third one is similar to the top layer and the forth is also similar to the second one. This observation indicates that the serpentine mud flow repeated several times at the interval in which the calcareous ooze deposited on the seafloor.

2) Sampling of a dead carbonate chimney

Dead carbonate chimney (about 1m high) near the leaving point was sampled. The chimney was fragile enough to sample by the manipulator. Obvious zonation within the chimney was not found at the cutting section. No cold seepage activity was found from this chimney. Also, no cold seep biological community which depends on chemosynthetic bacteria was found in this seamount.

3) MBARI sampling near the sampled chimney

In front of the dead carbonate chimney, two MBARI cores were successfully sampled. No cold seep activity and bilogogical community related to the cold seep was found in this area.

Principal Investigater: Hitoshi CHIBA Dive#369

Preliminary Results of KAIREI 7000II Dive #369

Purpose and the progress of this dive

Main purpose of this dive

The main objectives of this dive are;

(1) To make a topographic and geological cross sectional overview of Conical Seamoumt at the southern slope.

(2) To take rock samples along the Kaikou 7000II's survey line,

(3) To sample sediments by MBARI corers at the summit area for the geochemical analyses.

Historical Review of Survey Area (References)

The mud volcanoes at the outer Mariana forearc lie on the band that extends from 30 to 120km behind the trench axis (Fryer et al.,1985, 1995, 2000). Among these mud volcanoes, cold spring waters were first observed near the summit of Conical Seamout (Fryer et al., 1990). These springs had chimneys composed of aragonaite, calcite, and amorphous Mg-silicates. When one chimney was destroyed, it started to emit a slow flow of cold water with pH 9.3 and elevated dissolved carbonate.

Conical Seamout was drilled by Ocean Drilling Program (ODP) Site 780 in 1989 (Fryer et al., 1990). The analysed pore water sample had less than half the chloride content of seawater and a pH of 12.6. Relative to seawater it had higher to much higher sulfate, dissolved carbonate, ammonia, K, Rb, B, etc.; and lower to much lowerMg, Ca, Sr, Li, Si, phosphate, and Sr isotopic ratio (Mottl, 1992; Mottl et al., 2003).

During YK03-07 cruise using Shinkai 6500, one dive was devoted to observe the same area as prviously visited by many Alvin dive

Pre-dive Survey

Additon to the previous surveys, single line of multi-narrow beam bathymetric survay with SEA BEAM 2112 plus side scan sonar mode was carried out as a predive survey. The single line map made in this cruise had noise in the righthand side of the ship. This made the shape of the summit of the seamount different fromt the map made by "Yokosuka" in 2003. Therefore, dive was planed using the old "Yokosuka"'s map.

Principal Investigater: Hitoshi CHIBA Dive#369

Preliminary Results of KAIREI 7000II Dive #369

Dive Result 1

1) Topography

Dive was conducted at the suothern gentle slope near the summit of Conical seamount. Small scale topographyc features which were not described in the seabeam map are ridges made by serpentine mud flow and many cliffs a few meters high. The serpentine flow ridge were found frequently and their height were a few meters. They contain boulders in serpentine matrix. The cliffs of a few meters high are also seen frequently. Dead or broken carbonate chimenys were found mainly above 3150m. There is no mound structure like a hydrothermal mound around chimenys.

2) Geology

Characteristic geologic features of the diving area are serpentine mud flow ridge. They occur frequently and contain boulders of serpentinized peridotite and serpentinite. Cliffes of a few meters high were also observed frequently. Observation of the cliff shows that there are at least four layers. The top layer looks like brown at TV3 and consists of fine particles, probably calcareous ooze. The second layer contains white matrix and boulders, the serpentine mud flow. The third one is similar to the top layer and the forth is also similar to the second one. This observation indicates that the serpentine mud flow repeated several time at the interval in which the calcareous ooze deposited on the seafloor.

Dead and/or fallen carbonate chimneys were found about above 3150 m water depth. No cold seeqpage was observed around the chimney. Also,there is no biological comunity associated with the chimeny, confirming the absence of the active seepage now. No mound structure was observed at the base of the chimney. It may mean that the carbonate chimney grew in a single stage and the cold seep activity was short-lived.

Principal Investigater: Hitoshi CHIBA Dive#369

Preliminary Results of KAIKOU 7000II Dive #369

Dive Result 2

3) Biology

Population of the living things is scarce. They are sea cucumber, sea anemone and shrimp. The low population and lack of biological community indicate that the cold seepage does not occur at the diving area of this dive.

4) Others (Operation at sea floor)

MBARI core sampling

Principal Investigater: Hitoshi CHIBA Dive#369

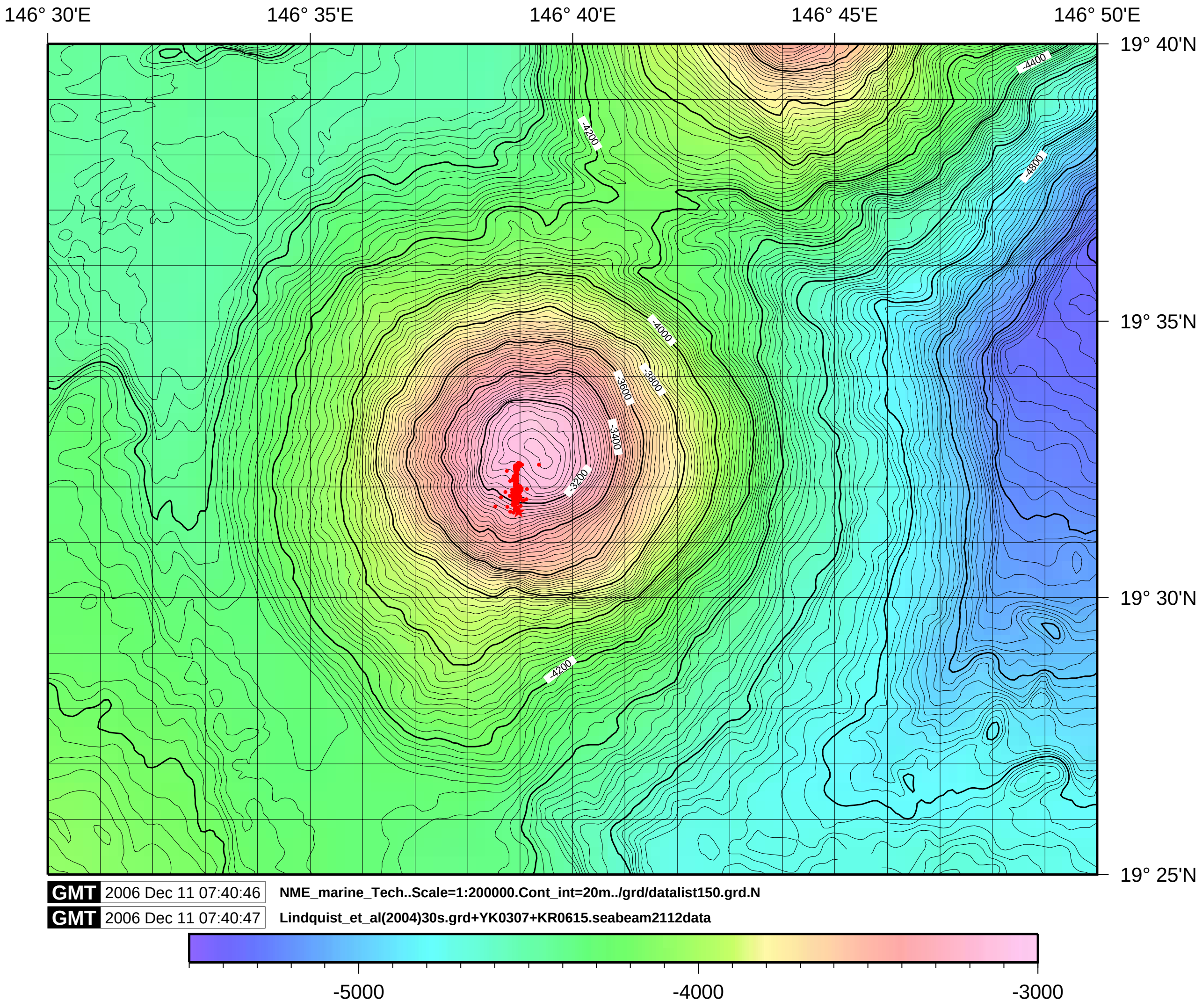
Preliminary Results of KAIREI 7000II Dive #369

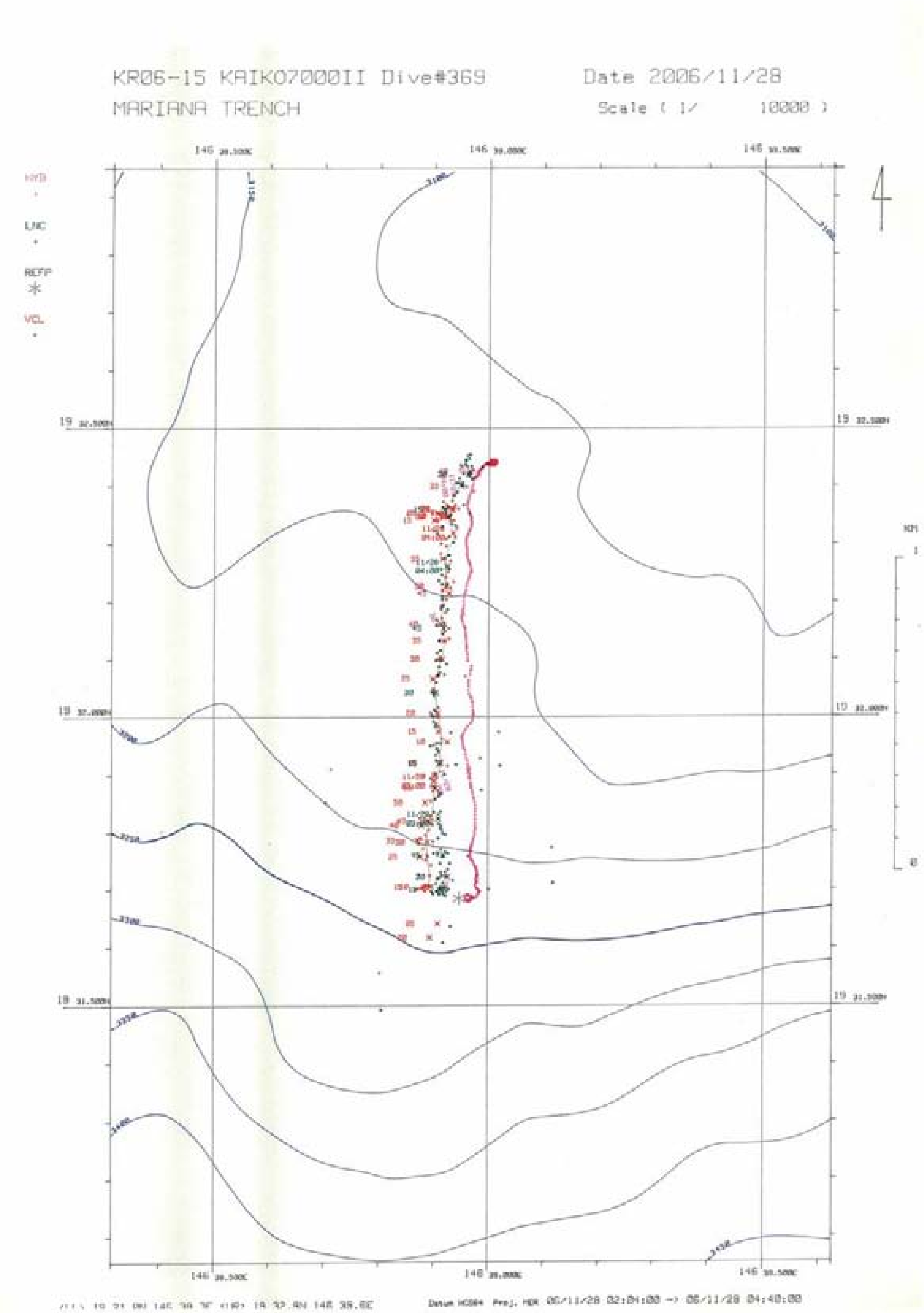
5 minutes highlight of each dive results

1)	12:09:40 ~ 12:10:32 TV 3 Sampling of the first rock sample.	0:00:52
2)	13:17:30 ~ 13:18:30 TV 3 Serpentine flow including boulders.	0:01:00
3)	13:46:00 ~ 13:48:00 TV 1 High serpentine cliff, debris flow unit, remarkably layered with peridotite block.	0:02:00
4)	14:04:45 ~ 14:05:05 TV 3 Purple colored octopus escaping from the veihicle	0:00:20
5)	14:22:00 ~ 14:22:30 TV 3 Sampling of the carbonate chimney	0:00:30
6)		0:00:00
7)		0:00:00
8)		0:00:00
9)		0:00:00
10)		0:00:00
11)		0:00:00
12)		0:00:00
13)		0:00:00
		Total Time: 04:42

Principal Investigater: Hitoshi CHIBA Dive#369

KR06-15.7K.Dive.369.Conical.SMT




KR06-15 KAIKO7000II Dive#369
Date 2006/11/28
MARIANA TRENCH
Scale (1/ 10000)
HYD
LNC
REFP
VCL
4
146 38.500E
146 39.000E
146 39.500E
19 32.500N
19 32.000N
19 31.500N
3100
3150
3200
3250
3300
3350
3400
3450
KM
1
0
11/28
04:00
Datum WGS84 Proj. MER 06/11/28 02:04:00 -> 06/11/28 04:40:00

Dive Log of 7K Dive #369 **Site Conical SMT** **2006/11/28**

Time (JST)	Dep. (m)	Alt. (m)	Head (Deg)	Description	Remarks	Latitude/ Longitude	
10:21				Landing on the water		19º-31.6822'N/ 146º-38.9579'E	
10:41				Start to decline		19º-31.6847'N/ 146º-38.9572'E	X: 0.0 Y: 26.7
11:53	3089	120	0	Leave the vehicle		19º-31.6945'N/ 146º-38.9177'E	X: 18.0 Y: -60.0
12:02	3199	8	156.85	visible on the bottom			
				muddy bottom with small chips			
				current ripple on the bottom			
12:04	3209	0	3	reached on the bottom		19º-31.6934'N/ 146º-38.9211'E	X: 16.0 Y: -54.0
12:06	3208	0	1	(st.1) try to get the sample (float)			
				two rocks and the rake			
				serpentine mud with pebble and boulders			
12:08	3208	0	56	(st.1) get the sample on this side of the box (large) (#369-R-01-01)	No.1	19º-31.6934'N/ 146º-38.9211’E	X: 16.0 Y: -54.0
12:11	3208	0	57.5	(st.1) get the sample on this side of the box (small) (#369-R-01-02)	No.2		
12:16	3208	0	57	(st.1) get the muddy serpentinite sample in the box (by the rake)	No.3		
12:19	3208	0	57	visible on pressure ridge			
12:21	3203	2	60	topographic gaps (reverse fault or serpentinite flow units)			
12:23	3199	3	16	many pebble (float)			
12:25	3196	2	350	current ripple on the bottom			
12:26	3195	2	352	outcrops (a little mud)			
12:32	3192	2	16	wall in the right side, pale reddish asteroid			
12:33	3192	1	6	current ripple on the bottom			
12:33	3190	3	5	many floating blocks on the muddy bottom			
12:36	3185	4	1	steep wall (about 5m gap)			
12:38	3186	2	0	many floating blocks (pebble) on the muddy bottom			
12:39	3183	3	1	steep wall, lower side : current ripple on the bottom			
12:48	3174	5	355	a little gap (about 2m height)			
12:49	3171	3	8	a few boulders and many pebbles on the bottom			
12:51	3172	0	1	a little gap (about 1m height)			
12:55	3170	0	8	a few boulders and many pebbles on the bottom			
12:55	3170	0	6.43	a fish			
12:57	3168	1	0	a little gap (about 2m height)			
12:58	3169	2	20	many rocks along the ridge (float)			
13:00	3171	2	8	current ripple on the bottom			
13:02	3176	0	6	pebbles on the muddy bottom			
13:04	3176	1	15	current ripple on the bottom and carbonate chimney(but only the base), no fluid			
13:08	3177	2	22	small and old two carbonate chimneys on the mud, no fluid			
13:10	3174	2	21	tulip with glassy sponge			
13:11	3173	0	13	a few boulders and a little gap (>1m)			
13:12	3174	2	5	muddy bottom			
13:13	3173	2	11	current ripple on the bottom with a little pebbles			
13:17	3170	0	8.24	serpentine follow, boulder			
13:20	3168	2	18	sonar shows four talus			
13:24	3165	2	0	serpentine outcrop			
13:28	3159	0	55	two old chimneys and with no fluid			
13:32	3158	2	27	the same chimney in the #179dive, after FUJIOKA			
13:34	3155	2	14.02	fault wall (0.5m high)			
13:37	3152	1	345	serpentinite fault (gap <0.5m)			
				old chimney (only the base)			
13:39	3149	3	48	fallen chimney on the muddy bottom			
13:40	3147	1	4	sea cucumber on the muddy bottom			
13:46	3141	3	15	Big serpentinite wall (lower side >2.0m, higher side >1.0m, total height >3m) debris flow unit ,remarkably layered with peridotite block. Rodingization and cementation. These units show the features of powder flow.			
13:51	3135	1	20	peridotite pebbles			
13:52	3134	0	1	flow gap(<2m)			
13:53	3136	1	10	fault			
13:53	3136	1	10	tulip			
13:54	3134	2	13	serpentinite pebbles			
13:57	3127	2	13	serpentinite flow edge (N40W)			
13:58	3127	2	18	serpentinite flow edge (N55W)			
14:00	3128	2	17	serpentinite outcrop			
14:01	3126	1	13	serpentinite flow edge (N80-90W)			
14:02	3128	3	350	red shrimp			
14:05	3127	2	0	outcrops (many old chimneys base), with sea cucumber			
14:05	3128	0	57	(St.2) try to get sample by MBARI (orange,30cm) The corer is full filled the pale yellow mud.	No.4	19º-32.3655'N/ 146º-38.9371'E	X: 1256.0 Y: -26.0
14:09	3128	0	57.31	(St.2) try to get sample by MBARI (green,50cm) The 1/3 corer is filled	No.5		
14:14	3128	0	58.15	(St.2) try to get sample by MBARI (red,50cm) The 1/2 corer is filled.	No.6		
14:21	3128	0	58.46	(St.3) get the big chimney sample (at the top of chimney) by the arm and sample in the basket. (#369-R-03-01)	No.7	19º-32.4360'N/ 146º-38.9600'E	X: 1312.0 Y: 14.0
14:24	3129	0	57.37	(St.4) get the sample used by the arm, sample is soft and put in the left side of the box (under the green MBARI) (#369-R-04-01)	No.8		
14:29	3130	0	47.7	(St.4) get the sample used by the rake, sample puts in the box	No.9		
14:40	3121	2	35	leave bottom		19º-32.4360'N/ 146º-38.9634'E	X: 1386.0 Y: 20.0
14:50	3011			combine the vehicle		19º-32.4468'N/ 146º-38.9726'E	X: 1406.0 Y: 36.0
15:57				surfacing		19º-32.4277'N/ 146º-39.0245'E	

Preliminary Results of KAIREI 7000II Dive #370

<table>
<tr><td>Dive No.</td><td>370</td><td>Date</td><td colspan="2">2006/11/29</td></tr>
<tr><td></td><td colspan="2">Name</td><td colspan="2">Affiliation</td></tr>
<tr><td>English</td><td colspan="2">Hirokazu MAEKAWA</td><td colspan="2">Osaka Prefecture University</td></tr>
<tr><td>Japanese</td><td colspan="2">前川 寛和</td><td colspan="2">Address</td></tr>
<tr><td>Speciality</td><td colspan="2">Metamorphic petrology</td><td colspan="2">1-1, Gakuen-cho, Naka-ku, Sakai, Osaka
599-8531, Japan</td></tr>
<tr><td>Theme</td><td colspan="4">Geologic reconnaissance of Pacman Seamount</td></tr>
<tr><td>Area</td><td colspan="4">Mariana Trench</td></tr>
<tr><td>Site</td><td colspan="4">Summit area of Pacman Seamount</td></tr>
<tr><td></td><td>Latitude</td><td>Longitude</td><td>Time</td><td>Depth</td></tr>
<tr><td>Landing</td><td>19º16.3885’ N</td><td>146º56.1071’ E</td><td>10:48</td><td>3143 m</td></tr>
<tr><td>Leaving</td><td>19º15.4410’ N</td><td>146º55.7715’ E</td><td>14:52</td><td>3036 m</td></tr>
<tr><td>Cruising Distance</td><td>1700 m</td><td>Deepest Point</td><td colspan="2">3143 m</td></tr>
<tr><td>Dive Summary</td><td colspan="4">The dive #370 surveyed at the eastern flank near the summit of Pacman Seamount. The aims of this dive are to take samples as many as possible for analysis of metamorphic and igneous petrology, and to find cold seep area at the summit. We intended to go ahead about 4 km by the first plan, but the vehicle was not able to move so far. So we actually pushed forward only 1.7 km, and just surveyed eastern slope along the dive course.
After the landing at the eastern slope of the seamount, we moved to SSW direction. The surface of the seamount is entirely covered with brownish mud materials with centimetric black colored fragments (probably serpentinite). Sub angular to sub rounded cobble to boulder-sized serpentinized peridotites are sometimes scattered on the surface of the slope. Ripple marks were observed frequently, and tracks of some animals are common.</td></tr>
<tr><td>Apparatus</td><td colspan="4">Box x1, MBARI corer: short(30cm) x 2, long(50cm) x 2, Rake x1</td></tr>
<tr><td>Visual Records</td><td colspan="4">TV1, TV2, TV3, Digital Still Camera 136</td></tr>
<tr><td>Samples</td><td colspan="4">Rocks 13, Cores: short x 2, long x 2, Rake</td></tr>
<tr><td>Key Words</td><td colspan="4">Pacman Seamount, serpentinized peridotite, serpentine flow</td></tr>
</table>

Principal Investigater: Hirokazu MAEKAWA Dive#370

Preliminary Results of KAIREI 7000II Dive #370

Summary of Results (For press)

Please write main three results of this dive.

1) Observation of the modes of occurrence of serpentine flow and serpentinized peridotites.

2) Sampling of serpentinized peridotite.

3) White colored blocks which are probably parts of base of chimney.

1) Observation of the modes of occurrence of serpentine flow and serpentinized peridotites.

Many large blocks of serpentinized peridotite are sporadically but intensely scattered in the fine-grained smooth mud surfaces. They are highly fragmented. Some of such area may represent outcrops of basement rocks, or may constitute a part of ridge of serpentine flow.

2) Sampling of serpentinized peridotite.

All samples we recovered during dive #370 are serpentinized harzburgite and dunite. Some samples retain original olivine, spinel, and orthopyroxene.

3) White colored blocks which are probably parts of base of chimney.

Just before the leaving the bottom, we found two subrounded blocks. One is 50cm in diameter, and another is more than 1 m in diameter. They are characteristically white in color, and may be parts of the base of chimneys. Unfortunately, we didn’t have time, we could not take any samples.

Principal Investigater: Hirokazu MAEKAWA Dive#370

Preliminary Results of KAIREI 7000II Dive #370

Purpose and the progress of this dive

Main purpose of this dive

The main objectives of the dive #370 are;

1) Sampling of serpentinized peridotites to examine petrological heterogenity among each seamount, and to examine lateral variation of serpentine mineals from the trench to eastward.

2) Sampling of metamorphic rocks to understand the nature of metamorphism which prevailed below forearc.

3) Looking for chimneys and taking sediments by MBARI corerer to examine interstitial water.

Historical Review of Survey Area (References)

P. Fryer and her coworlkers had many works on the topography, petrology and tectonics of the serpentine seamount in the Mariana Forearc. Her and her colleague's work started from 1981 and published several tens papers concerning serpentine seamount. JAMSTEC research vessel visited here in 1992 to have three dives (#178 at Pacman Seamount, #179 at Conical Seamount and #180 at Coni-Pac triangle), and R/V Yokosuka with Shinkai 6500 carried out the biological servey at the southeastern arm of the crescent-shaped Pacman Seamounts.

Pre-dive Survey

SeaBeam swath mapping of the Pacman Seamount was carried out by R/V Yokosuka in 2003 covering the whole seamount. Night survey of theservey area of the seamount was carried out before the dive #370.

Principal Investigater: Hirokazu MAEKAWA Dive#370

Preliminary Results of KAIREI 7000II Dive #370

Dive Result 1

1) Topography

We landed at the eastern flank of summit of Pacman seamount. The landing point was smooth and gentle slope, and covered with thick muddy materials. Many large blocks of serpentinized peridotite are sporadically but intensely scattered in the fine-grained smooth mud surfaces. Some of such area may represent outcrops of basement rocks, or may constitute a part of ridge of gravity flow of serpentinite materials.

2) Geology

Characteristic geologic features of the diving area are sporadically but intensely distributed rocky outcrops of serpentinized peridotites. All samples taken in this dive are serpentinized peridotites or serpentinites. The most notably thing is that the area is exclusively occupied by these rocks.

Two white-colored blocks were recognized at the leaving point. They are 50-100cm in diameter, and looks like some kind of carbonate rock. They may be parts of the base of chimneys. although we could not take any samples.

Principal Investigater: Hirokazu MAEKAWA Dive#370

Preliminary Results of KAIKOU 7000II Dive #370

Dive Result 2

3) Biology

Some kinds of fish, seastars, red shrimps, glassy sponges are often found. Animal tracks are also commonly observed on the muddy sea floor.

4) Others (Operation at sea floor)

MBARI core sampling

Principal Investigater: Hirokazu MAEKAWA Dive#370

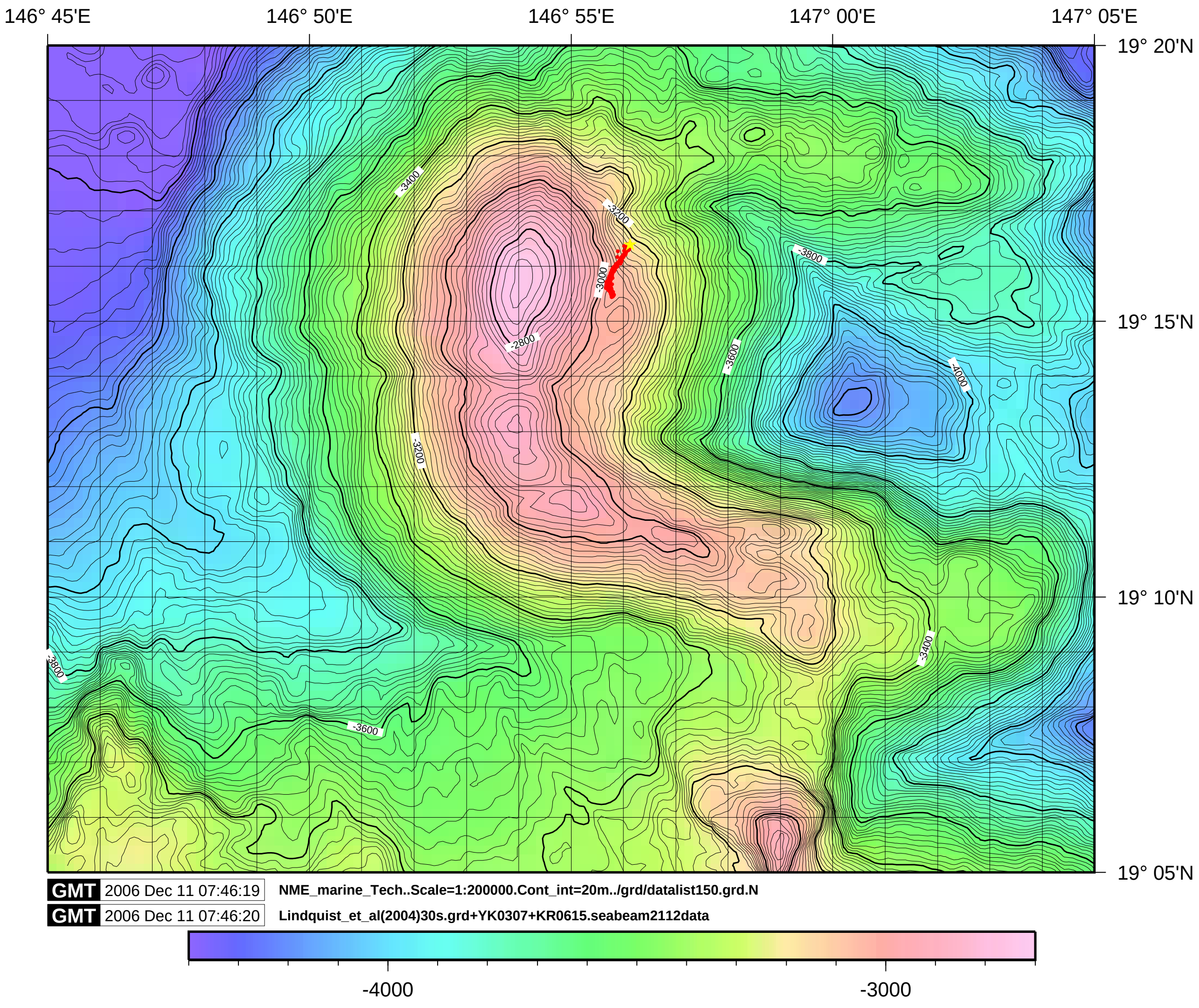
Preliminary Results of KAIREI 7000II Dive #370

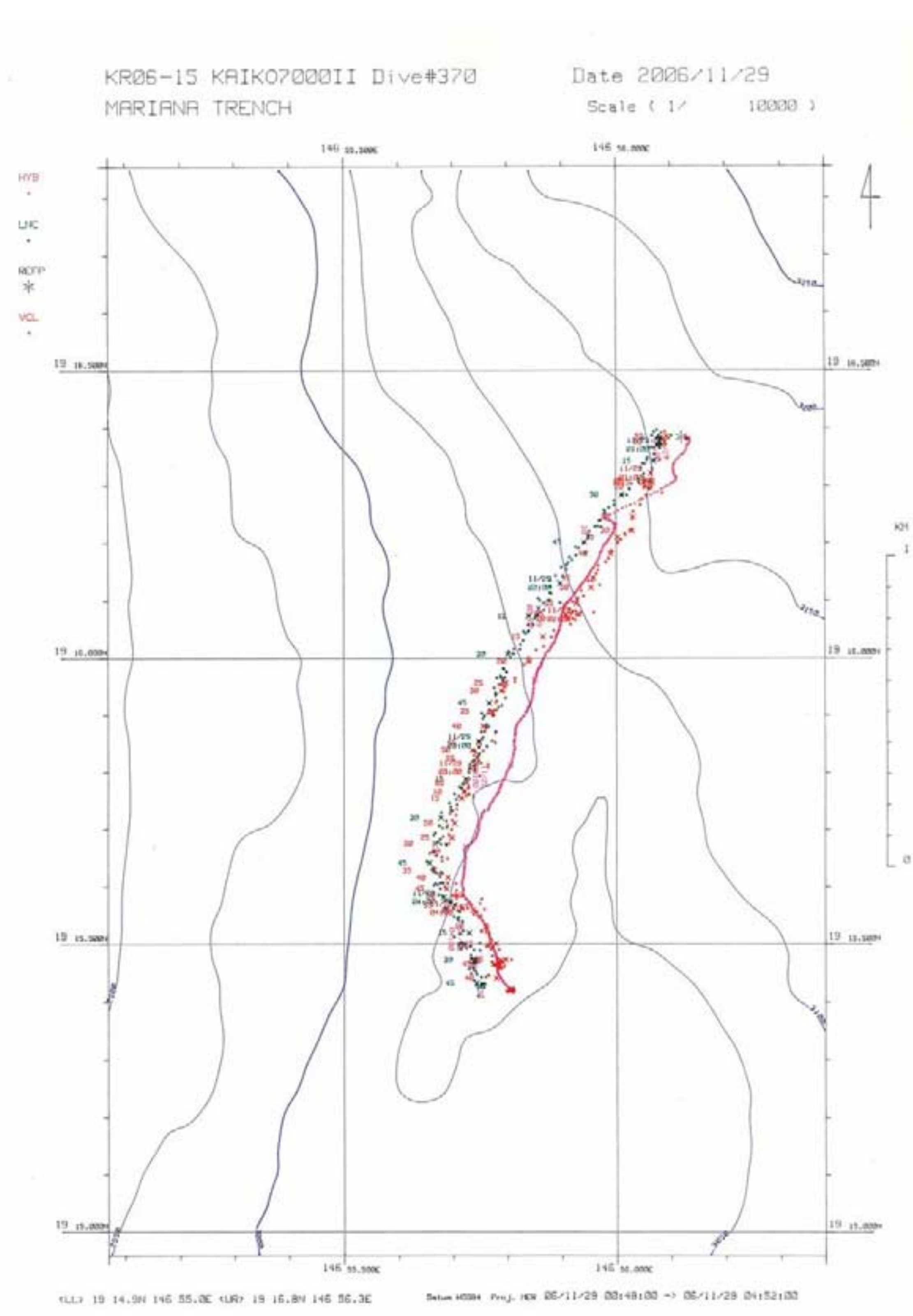
5 minutes highlight of each dive results

1)	10:47:25~10:47:40	Depth 3143 m	TV 3	Layers including pebbly-sized serpentinite fragments.	0:00:15
2)	10:51:00~10:51:35	Depth 3143 m	TV 3	Sampling of pebbly-sized rock fragments by rake.	0:00:35
3)	11:29:10~11:29:45	Depth 3115 m	TV 3	Serpentinized peridotites exclusively occupy rocky parts of serpentine flows.	0:00:35
4)	11:34:00~11:34:35	Depth 3109 m	TV 3	A fish swimming quietly above the serpentine flow region.	0:00:35
5)	11:35:30~11:36:00	Depth 3107 m	TV 3	Rocky surfaces of serpentinized peridotite and a starfish.	0:00:30
6)	12:03:45~12:04:40	Depth 3069 m	TV 3	Sampling of serpentinized peridotite by a manupilator	0:00:55
7)	13:09:00~13:09:10	Depth 3022 m	TV 3	A Glassy sponge with a star fish on the muddy surface near serpentinized peridotites.	0:00:35
8)	13:18:50~13:19:10	Depth 3021 m	TV 3	A fish is swimming near the summit of Pacman Seamount.	0:00:20
9)	13:21:15~13:21:30	Depth 3021 m	TV 3	A fish is swimming near the summit of Pacman Seamount.	0:00:15
10)	13:25:07~13:25:32	Depth 3021 m	TV3	Surface of muddy slope and a red shrimp.	0:00:25
11)					0:00:00
12)					0:00:00
13)					0:00:00
					Total Time: 05:00

Principal Investigater: Hirokazu MAEKAWA Dive#370

KR06-15.7K.Dive.370.Pacman.SMT




KR06-15 KAIKO7000II Dive#370
Date 2006/11/29
MARIANA TRENCH
Scale (1/ 10000)
HYB
LHC
RCFP
VCL
146 55.500E
146 56.000E
19 16.500N
19 16.000N
19 15.500N
19 15.000N
4
KM
1
0
<LL> 19 14.9N 146 55.0E <UR> 19 16.8N 146 56.3E
Datum WGS84 Proj. MCM 06/11/29 00:48:00 -> 06/11/29 04:52:00

Dive Log of 7K Dive #370 Site Pacman SMT 2006/11/29

Time (JST)	Dep. (m)	Alt. (m)	Head (Deg)	Description	Remarks	Latitude/ Longitude	
10:02	1310	121	75	driving for the sea floor			
10:13	2018	99	129	launcher depth: 2000m, driving for the sea floor			
10:37	3021	120	77	leave the vehicle			
10:46	3134	9	197	visible on the bottom			
10:48	3143	0	188	arrive to the sea bottom(st.1), current ripple			
10:48	3143	0	212	(st.1) serpentinite pebbles on the muddy floor		19º-16.3885'N/ 146º-56.1071'E	X: 10.0 Y: -32.0
10:52	3143	0	212	(st.1) get the serpentine muds including blacky pebbles used by rake in the black box	No. 1(box)		
10:55	3142	2	218	leave the bottom, pebble-sized blocks on muddy foor, trails by echinoid, current ripple			
10:59	3140	2	208	trails by echinoid			
11:06	3136	2	238	(st.2) boulder-sized (<1m) blocks, ripple current			
11:10	3136	0	258	(st. 2) get the serpentinite block by the arm, put in the small basket(red lined) (#370-02R-01)	No. 2	19º-16.2909'N/ 146º-56.0637'E	X: -170.0 Y: -108.0
11:14	3136	0	244	(st. 2) get the smaller serpentinite block by the arm, put in the small basket(red lined) (#370-02R-02)	No. 3		
11:16	3136	0	244	(st. 2), rake was broken, but can get the sample of the serpentine muds, put in the black box	No. 4(box)		
11:19	3135	1	212	leave the bottom			
11:21	3130	1	210	current ripple, boulder-sized (<1m) serpentinite blocks on the serpentine mud floor including black pebbles			
11:29	3114	3	201	current ripple, very large boulder-sized (<2m) serpentinite blocks (peridotite?)			
11:32	3112	1	207	mummy of BORUBONIAN?			
11:34	3109	1	193	a fish			
11:35	3107	4	219	serpentinite mound (1m high)			
11:37	3105	2	203	red shrimp			
11:38	3104	2	213	current ripple			
11:38	3103	3	210	a fish			
11:38	3103	3	210	variably-sized serpentinite blocks			
11:44	3093	2	167	srepentine muds including black pebbles, current ripple			
11:48	3089	3	207	boulder-sized serpentinite blocks			
11:52	3039	2	219	boulder-sized serpentinite blocks			
11:52	3039	2	219	red shrimp			
11:53	3076	1	215	a fish			
11:53	3076	1	215	current ripple			
11:56	3070	2	193	variably-sized serpentinite blocks that are widely distributed			
11:57	3069	4	208	arrive to the bottom, manganese-coated blocks			
12:04	3070	0	214	(St.3) get the serpentinite block by the arm, put in the basket that is located at rake before (right-hand side of the black box). This site is a serpentinite outcrop that is highly sheared (by Prof. Yokose-san) (#370-03R-01)	No. 5	19º-16.0752'N/ 146º-55.9245'E	X: -568.0 Y: -352.0
12:05	3069	1	200	(St.3) get the serpentinite block by the arm, put in the basket that was located at rake before (#370-03R-02)	No. 6		
12:06	3069	1	203	(St.3) get the serpentinite block by the arm, put in the basket that was located at rake before (#370-03R-03)	No. 7		
12:07	3069	1	205	(St.3) get the serpentinite block by the arm, put in the basket that was located at rake before (#370-03R-04)	No. 8		
12:08	3068	2	191	leave the bottom, asteroid			
12:09	3064	4	223	current ripple			
12:12	3056	2	199	white fish, current ripple (E-W striking ridges)			
12:25	3032	3	235	serpentinite blocks that are widely outcroped, making mounds (ridge in about 2m in high)			
12:35	3029	2	197	serpentinite blocks that are widely outcroped			
12:41	3028	2	200	red shrimp, current ripple (E-W striking ridge), serpentinite blocks(1m in size）			
12:49	3025	1	199	serpentinite blocks on the muddy floor (peridotite?)			
12:54	3024	0	193	arrive to the bottom(st.4), get the serpentinite block, put in the large basket beside the small basket (red lined) (#370-04R-01)	No. 9	19º-15.8215'N/ 146º-55.7486'E	X: -1036.0 Y: -660.0
12:55	3024	0	197	(st.4) get the serpentinite block in the large basket beside the small basket (red lined). (#370-04R-02)	No. 10		
12:56	3024	0	196	(st.4) get the serpentinite (peridotite?) block in the large basket beside the small basket (red lined). (#370-04R-03)	No. 11		
12:57	3023	1	197	leave the bottom			
13:00	3022	2	196	current ripple (N70-80W striking ridge)			
13:05	3022	0	221	glass sponge, dark-colored fish			
13:07	3022	0	201	black-colored pebbles in serpentine muds			
13:08	3022	0	199	arrive to the sea bottom, fail to get the sample by rake			
13:15	3021	2	191	leave the bottom			
13:19	3021	0	191	big fish!!			
13:26	3021	1	190	variably-sized (<2m) serpentinite blocks			
13:39	3025	0	177	course change to point 3			
13:40	3027	2	160	on course			
13:40	3027	2	160	current ripple, rounded pebbles			
13:53	3038	2	155	arrive to the bottom, (st.5)			
13:58	3039	0	154	(st. 5) get the serpentine mud core used by MBARI (blue color, 30 cm in high). The 1/1 corer is filled.	No. 12	19º-15.5656'N/ 146º-55.7098'E	X: -1508.0 Y: -728.0
14:00	3039	0	135	leave the bottom			
14:15	3042	3	136	serpentinite boulders (>1m)			
14:17	3043	0	121	arrive to the bottom			
14:18	3043	0	121	(st.6) get the serpentinite block (yellow color), put in the large basket beside the small basket (#370-06R-01)	No. 13	19º-15.4984'N/ 146º-55.7817'E	X: -1632.0 Y: -602.0
14:20	3043	0	121	(st.6) get the serpentinite block (smaller than No. 13), put in the large basket beside the small basket (#370-06R-02)	No. 14		
14:21	3043	0	119	leave the bottom			
14:22	3042	2	144	current ripple			
14:24	3037	2	137	serpentinite blocks			
14:26	3039	0	217	arrive ot the bottom			
14:29	3039	0	217	(st.7) get the serpentine mud core by MBARI (yellow color, 30 cm in high). The 1/1 corer is filled.	No. 15	19º-15.4659'N/ 146º-55.7875'E	X: 1692.0 Y: -592.0
14:35	3039	0	217	(st.7) get the serpentine mud core by MBARI (red color, 50 cm in high). deg. 217. The 3/5 corer is filled.	No. 16		
14:43	3039	0	217	(st.7) get the serpentine mud core by MBARI (green color, 50 cm in high). deg.217. The 1/1 corer is filled.	No. 17		
14:44	3038	2	141	leave the bottom			
14:46	3037	1	159	(st.7) get the serpentinite block by the arm, put in the basket of rake (#370-07R-01)	No.18		
14:48	3037	0	159	(st.7) get the serpentinite block by the arm, put in the basket of rake, located at site above No. 18 sample (#370-07R-02)	No. 19		
14:49	3030	3	134	leave the bottom, serpentinite blocks			
14:51	3035	1	233	layered serpentinite outcrop(?), having a schistosity (antigorite schist?)			
14:52	3036	0	88	leave the bottom		19º-15.4410'N/ 146º-55.7715'E	X: -1738.0 Y: -620.0

Preliminary Results of KAIREI 7000II Dive #371

Dive No.	371	**Date**	2006/11/30	
	Name		**Affiliation**	
English	Hirokazu MAEKAWA		Osaka Prefecture University	
Japanese	前川 寛和		**Address**	
Speciality	Metamorphic petrology		1-1, Gakuen-cho, Naka-ku, Sakai, Osaka 599-8531, Japan	
Theme	Geologic reconnaissance of Twin Peaks 3 Seamount			
Area	Mariana Trench			
Site	Twin Peaks 3 Seamount			
	Latitude	**Longitude**	**Time**	**Depth**
Landing	18º35.90' N	146º58.57' E	10:50	2948 m
Leaving	18º35.49' N	146º58.26' E	14:43	2632 m
Cruising Distance	1300 m	**Deepest Point**	2948 m	

Dive Summary

We found three unknown seamounts between Pacman Seamount and Big Blue Seamount by pre-dive bathymetric survey. These newly found seamounts have two peaks suggesting multiple history of development. In order to observe the cross-cut section of the seamount, we chose the southern most seamount which was cut by fault and shows half-moon shape. We tentatively call this seamount “Twin Peaks 3 Seamount”.

Landed at the eastern steep slope of the seamount, we moved to the west toward the summit. The surface of the slope was partly covered with muddy soft materials, but cliffs of serpentinized peridotite are often obserbed.Serpentinized peridotites are massive, but sheared fabrics are partly developed. Basalt, basaltic breccia, and their metamorphic equivalents are rarely found as relatively small blocks. Small fragments of gray and red cherts are also found near the summit.

Apparatus	MBARI corer short(30cm) x 3, long(50cm) x 2, rake x 1
Visual Records	TV1, TV2, TV3, Digital Still Camera 230
Samples	Rocks 25, Cores: short x 2, long x 1
Key Words	serpentinite, serpentinized peridotite, Twin Peaks, forearc

Preliminary Results of KAIREI 7000II Dive #371

Summary of Results (For press)

Please write main three results of this dive.

1) Observation of the steep slope showing the cross-cut section of serpentinite seamount.

2) Sampling of constituent rocks.

3)

1) Observation of the steep slope showing the cross-cut section of serpentinite seamount.

Cliffs of a few meters high were frequently found during the dive. The cliff consists mainly of mussive serpentinized peridotites. These peridotites are probably main constituent rocks of the seamount. We were successfully able to observe the host rocks inside the seamount.

2) Sampling of constituent rocks.

Twenty five rocks were sampled. Most of rocks are serpentinized peridotite. Basalt, basaltic breccia, and their metamorphic equivalents are found as cobble-sized blocks. It is necessary to address the origin of basaltic blocks through geochemical and petrological studies to understand the formation process of the seamount.

3)

Principal Investigater: Hirokazu MAEKAWA Dive#371

Preliminary Results of KAIREI 7000II Dive #371

Purpose and the progress of this dive

Main purpose of this dive

The main objectives of this dive are;

(1) To make a cross sectional overview of the Twin Peaks 3 Seamoumt.

(2) To take rock samples along the Kaikou 7000II's survey line,

(3) To sample sediments by MBARI corers at the summit area for the geochemical analyses.

Historical Review of Survey Area (References)

The outlines of the seamounts are recognized in the previous bathymetric map of Fryer et al. (1999) and Scientific shipboard party (2001). The Twin Peaks 3 Seamount, however, has never been introduced in any journals and publications, although it could be a key to solve the formation process of serpentinite seamount. We fortunately found the seamount by filling the blank area by seabeam survey. We must check whether the seamount has name or not.

Pre-dive Survey

Single line of multi-narrow beam bathymetric survay with SEA BEAM 2112 plus side scan sonar mode was carried out before the dive #371.

Principal Investigater: Hirokazu MAEKAWA Dive#371

Preliminary Results of KAIREI 7000II Dive #371

Dive Result 1

1) Topography

Topography along the dive course is the repetition of steep slope covered with muddy sediments and steep cliff of massive serpentinized peridotites. A normal fault runs in NNW-SSE direction near the center of the seamount, and eastern half of the seamount was collapsed to form relatively flat plateau with lower height.

2) Geology

We found three unknown seamounts between Pacman Seamount and Big Blue Seamount by pre-dive bathymetric survey. These newly found seamounts have two peaks suggesting multiple history of development. In order to observe the cross-cut section of the seamount, we chose the southern most seamount which was cut by fault and shows half-moon shape. The surface of the slope was partly covered with muddy soft sediments, but cliffs of serpentinized peridotite are often obserbed.Serpentinized peridotites are commonly massive, but sheared fabrics are partly developed. Muddy soft sediments contain foraminiferal tests and erratic serpnetinite fragments. Basalt, basaltic breccia, and their metamorphic equivalents are rarely found as relatively small blocks. Small fragments of gray and red cherts are also found near the summit.

Principal Investigater: Hirokazu MAEKAWA Dive#371

Preliminary Results of KAIKOU 7000II Dive #371

Dive Result 2

3) Biology

Some kinds of fish, jelly fish, grey shrimp, glassy sponge are found.

4) Others (Operation at sea floor)

MBARI core sampling

Principal Investigater: Hirokazu MAEKAWA Dive#371

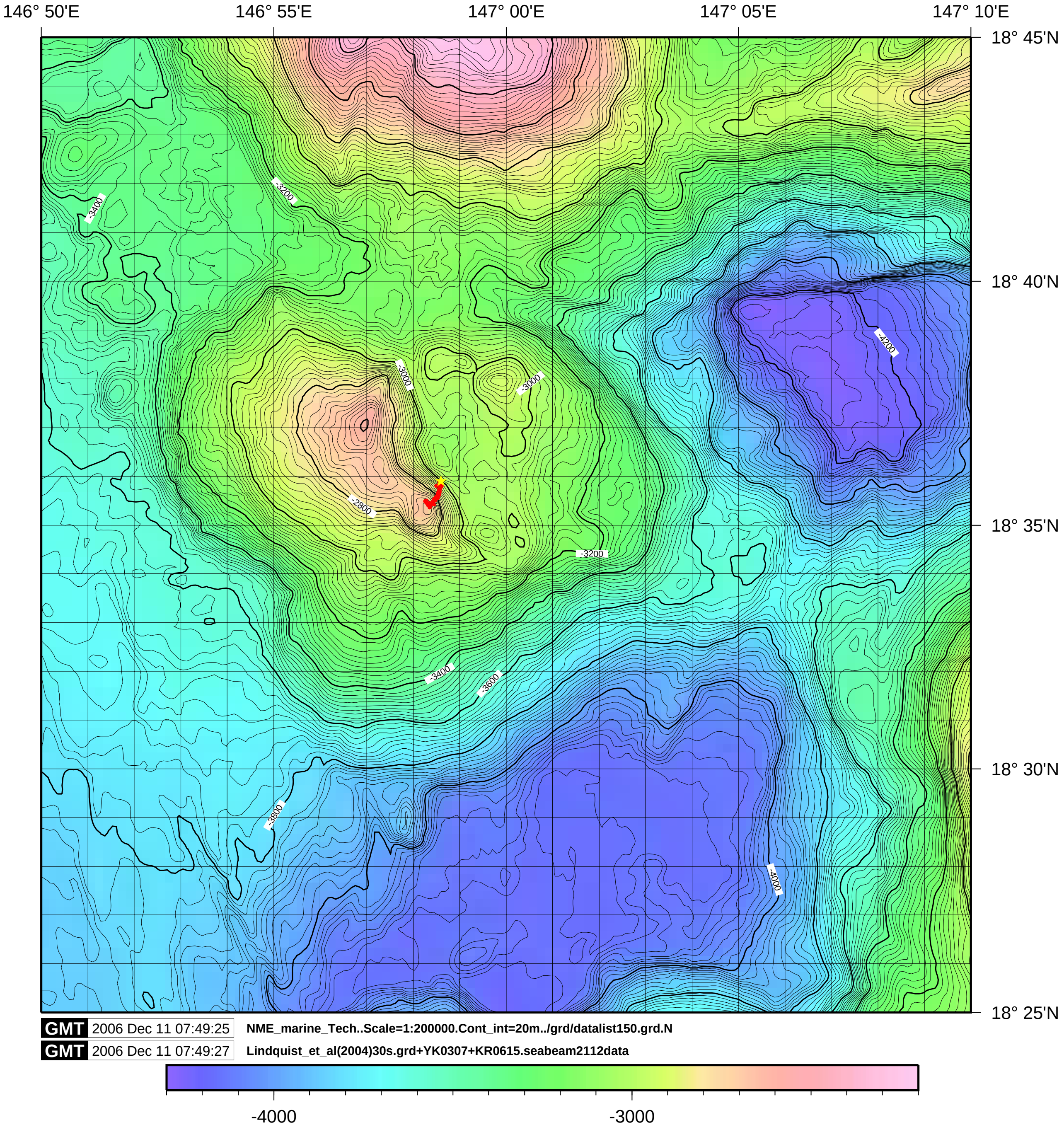
Preliminary Results of KAIREI 7000II Dive #371

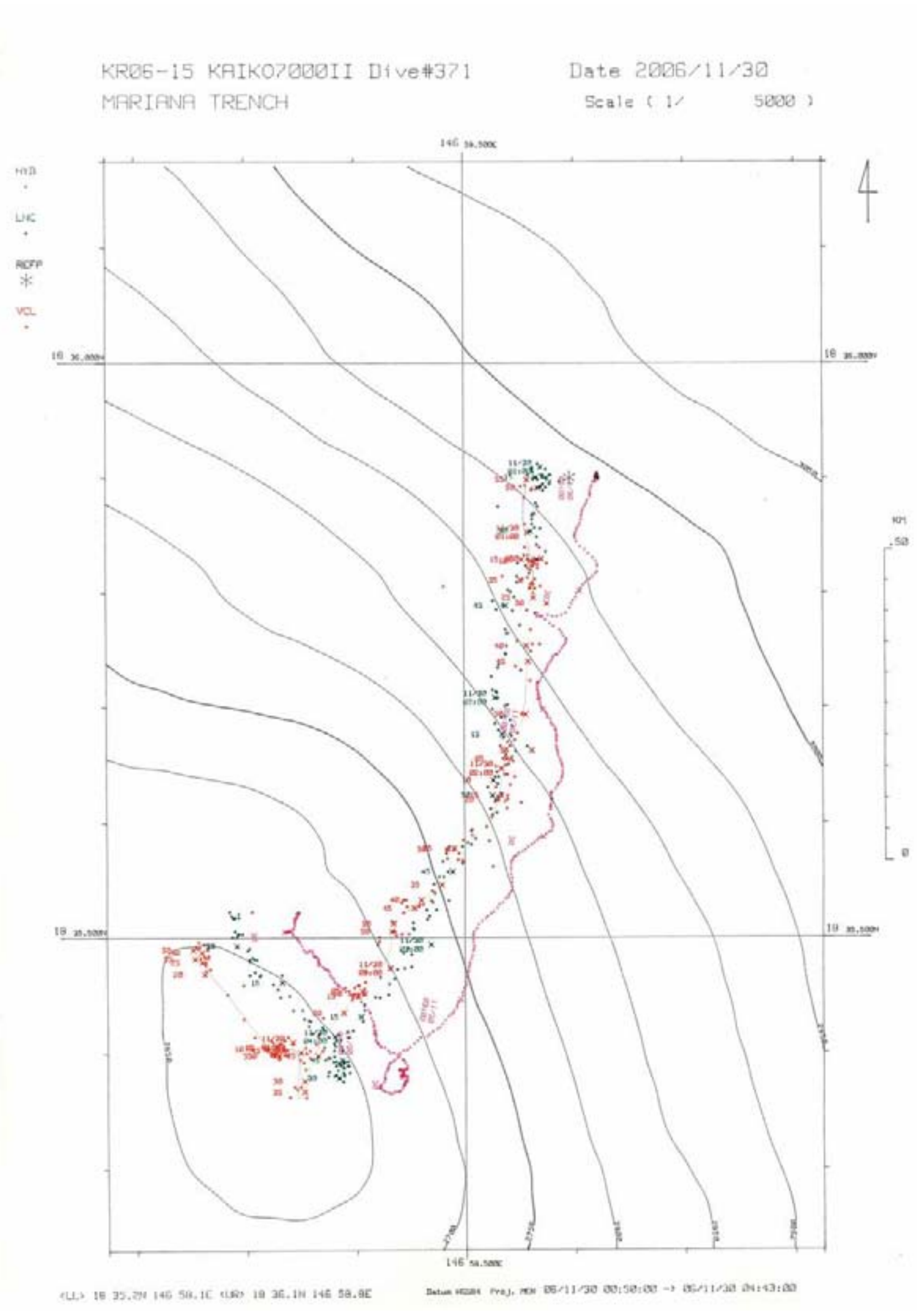
5 minutes highlight of each dive results

1)	10:51:20 ~ 10:52:00 Depth 2948 m TV 3 Sampling of peridotite blocks by manupilator at steep slope.	0:00:40
2)	10:57:10 ~ 10:57:35 Depth 2935 m TV 3 General view of steep slope during the dive #371.	0:00:25
3)	11:07:45 ~ 11:08*30 Depth 2808 m TV 3 Sampling of pebble sized fragments of rocks by rake.	0:00:45
4)	11:21:35 ~ 11:22:05 Depth 2808 m TV 3 General view of steep slope during the dive #371.	0:00:30
5)	11:24:40 ~ 11:25:00 Depth 2792 m TV 3 Large outcrops of serpentinized peridotite.	0:00:20
6)	11:47:50 ~ 11:49:00 Depth 2753 m TV 3 General view of rocky steep.	0:01:10
7)	12:47:45 ~ 12:48:10 Depth 2571 m TV 3 A white-chlored slander fish.	0:00:25
8)	13:18:20 ~ 13:18:30 Depth 2489 m TV 3 A white-chlored slander fish in the rocky outcrop.	0:00:10
9)	13:27:40 ~ 13:27:50 Depth 2445 m TV 3 More fish.	0:00:10
10)	13:58:50 ~ 13:59:15 Depth 2467 m TV 3 Putting Marker #371 for the future revisit.	0:00:25
11)		0:00:00
12)		0:00:00
13)		0:00:00
		Total Time: 05:00

Principal Investigater: Hirokazu MAEKAWA Dive#371

KR06-15.7K.Dive.371.TwinPeaks3.SMT




KR06-15 KAIKO7000II Dive#371
Date 2006/11/30
MARIANA TRENCH
Scale (1/ 5000)
146 58.500E
HYB
LNC
REFP
VCL
18 36.000N
18 35.500N
KM
.50
0
4
<LL> 18 35.2N 146 58.1E <UR> 18 36.1N 146 58.8E
Datum WGS84 Proj. MER 06/11/30 00:50:00 -> 06/11/30 04:43:00

Dive Log of 7K Dive #371 **Site Twin Peaks 3 SMT** **2006/11/30**

Time (JST)	Dep. (m)	Alt. (m)	Head (Deg)	Description	Remarks	Latitude/ Longitude	
10:36	2822	122	73	leave the vehicle		18º-35.8978’N/ 146º-58.5716’E	X: -4.0 Y: -50.0
10:47	2937	17	195	visible on the bottom, serpentinite blocks on the sea floor			
10:50	2948	3	242	(st.1) arrive to the bottom, get the serpentinite block by the arm, put in the box (F:#371-01R-01)	No. 1	18º-35.8935’N/ 146º-58.5750’E	X: -12.0 Y: -44.0
10:53	2948	3	245	(st.1) get the serpentinite block by the arm, put in the box (F:#371-01R-02)	No. 2		
10:54	2948	2	245	leave the bottom			
10:59	2927	4	186	a fish near the bottom			
11:01	2918	2	185	current ripple			
11:02	2916	3	222	large serpentinite block (<3m)			
11:04	2915	0	243	arrive to the bottom			
11:06	2915	0	242	(st.2) get the serpentinite block (largest, surrounded by the muds) by the arm, put in the box (F:#371-02R-01)	No. 3	18º-35.8274'N/ 146º-58.5963’E	X: -134.0 Y: -54.0
11:09	2915	0	241	(st.2) get the serpentine muds in cluding black pebbles by the rake, put in the black box (B)	No. 4(black box)		
11:20	2915	0	241	(st.2) get the serpentine muds used by MBARI (black, 30cm in high). The 3/4 corer is filled.	No. 5(MBARI)		
11:20	2915	2	230	leave the bottom			
11:22	2911	2	185	a red shrimp			
11:22	2906	2	185	serpentinite blocks (<5m)			
11:25	2907	0	139	(st. 3) arrive to the bottom, get the serpentinite block (or muds?) by the arm, put in the box (F:#371-03R-01).	No. 6	18º-35.8046'N/ 146º-58.5795'E	X: -176.0 Y: -36.0
11:27	2907	0	148	(st. 3) get the serpentinite block (or muds?, rounded shape) by the arm, put in the box (F:#371-03R-02).	No. 7		
11:33	2907	0	148	(st. 3) get the serpentine muds by the rake, put in the black box (B).	No. 8(black box)		
11:35	2907	2	178	leave the bottom			
11:37	2900	3	193	current ripple and load cast			
11:39	2881	6	177	serpentinite blocks on the serpentine muds. Outcrop?			
11:43	2879	0	240	(st. 4) arrive to the bottom, get the serpentinite block by the arm, put in the box (E:#371-04R-01).	No. 9	18º-35.7547'N/ 146º-58.5625'E	X: -268.0 Y: -66.0
11:43	2878	3	212	leave the bottom			
11:49	2842	5	189	sponge			
11:55	2820	3	180	a white fish			
12:13	2794	1	225	(st.5) arrive to the bottom, get the serpentinite block (having a schistosity?) by the arm, put in the box (E:#371-05R-01)	No.10	18º-35.6181'N/ 146º-58.5500'E	X: -520.0 Y: -88.0
12:16	2794	1	228	(st.5) get the serpentinite block by the arm, put in the box (E:#371-05R-02)	No.11		
12:17	2794	3	225	(st.5) get the serpentinite block by the arm, put in the box (E:#371-05R-03)	No.12		
12:19	2792	5	226	leave the bottom			
12:24	2756	2	228	serpentine mud-flow?			
12:26	2749	0	246	(st.6) arrive to the bottom, get the serpentinite block by the arm, put in the box (A:#371-06R-01).	No. 13	18º-35.5628'N/ 146º-58.4965'E	X: -622.0 Y: -182.0
12:30	2749	0	246	(st.6) arrive to the bottom, get the serpentinite block(or muds?) by the arm, put in the box (A:#371-06R-02).	No. 14		
12:32	2745	4	214	leave the bottom			
12:48	2702	2	236	white fish?			
12:49	2698	0	250	arrive to the bottom (st.7)			
12:51	2698	0	250	(st.7) get the serpentintie block by the arm, put in the box (A:#371-07R-01)	No. 15	18º-35.5064'N/ 146º-58.4385'E	X: -726.0 Y: -284.0
12:52	2698	0	250	(st.7) get the serpentintie block by the arm, put in the box (A:#371-07R-02)	No. 16		
12:53	2698	0	252	(st.7) get the serpentintie block by the arm, put in the box (A:#371-07R-03)	No. 17		
12:55	2698	5	254	leave the bottom			
12:56	2694	3	218	current ripple			
12:57	2692	2	262	two yellowish brown colored blocks			
13:02	2664	2	214	near the summit			
13:04	2654	2	231	(st.8) large serpentinite outcrop!!(<10m)			

Dive Log of 7K Dive #371 Site Twin Peaks 3 SMT 2006/11/30

Time (JST)	Dep. (m)	Alt. (m)	Head (Deg)	Description	Remarks	Latitude/ Longitude	
13:06	2654	0	231	(st. 8)arrive to the bottom, get the serpentinite block by the arm, put in the box(F:#371-08R-01)	No.18	18º-35.4544'N/ 146º-58.4021'E	X: -822.0 Y: -348.0
13:07	2654	0	231	(st.8) get the serpentinite block by the arm, put in the box (E#371-08R-02)	No.19		
13:07	2654	0	231	(st.8) get the serpentinite block by the arm, put in the box (F:lost)	No.20		
13:09	2654	4	222	leave the bottom			
13:13	2640	0	302	(st.9) arrive to the bottom, get the serpentinite block by the arm, put in the box (A:#371-09R-01)	No.21	18º-35.4490'N/ 146º-58.4010'E	X: -832.0 Y: -350.0
13:16	2640	0	299	(st.9) get the serpentinite block (outcrop) by the arm, put in the box (A:#371-09R-02)	No.22		
13:17	2640	4	248	leave the bottom			
13:18	2633	1	206	eel			
13:22	2598	3	227	(st 10) outcrop, large serpentinite block (<5m)			
13:23	2595	0	292	(st.10) arrive to the bottom, get the serpentinite block (highly sheared?) by the arm, put in the box (D:#371-10R-01)	No.23	18º-35.4002'N/ 146º-58.3623’E	X: -922.0 Y: -418.0
13:25	2595	2	287	(st.10) get the serpentinite block by the arm, put in the box (A:#371-10R-02)	No.24		
13:27	2595	3	258	leave the bottom, big fish			
13:30	2598	4	224	current ripple			
13:33	2505	6	32	change the cource			
13:37	2596	2	354	big sponge?			
13:38	2594	1	5.94	arrive at the top (singular point 3)			
13:41	2598	0	349	(st.11) arrive to the bottom, get the serpentinite block by the arm, put in the box (A:#371-11R-01)	No.25	18º-35.4002'N/ 146º-58.3430’E	X: -922.0 Y: -452.0
13:45	2599	0	349	(st.11) get the serpentinite block by the arm, put in the box (A:#371-11R-02)	No.26		
13:46	2599	1	318	leave the bottom			
13:46	2599	0	312	arrive to the bottom (st.11)			
13:48	2599	0	299	(st.11) get the serpetine flow by the rake, put in the black box (B)	No.27(black box)	18º-35.4002'N/ 146º-58.3430’E	X: -922.0 Y: -452.0
13:55	2600	0	287	(st.11) try to get the serpetine flow used by the MBARI (blue color, 30cm in high), but failed.			
13:57	2600	0	268	(st.11) get the serpetine flow used by the MBARI (blue color, 30cm in high). The 1/4 corer is filled.	No.28(MBARI)	18º-35.4002'N/ 146º-58.3430’E	X: -922.0 Y: -452.0
13:58	2600	0	267	set a flag (KAIKO7000II) on the floor!!		18º-35.3991'N/ 146º-58.3362'E	X: -924.0 Y: -464.0
14:00	2600	1	254	leave the bottom			
14:01	2605	0	304	arrive to the bottom (st.12)			
14:04	2605	0	304	(st.12) get the serpentine flow by the rake, put in the balck box (B)	No.29(black box)	18º-35.4002'N/ 146º-58.3282'E	X: -920.0 Y: -478.0
14:13	2605	0	304	(st.12) get the serpetine flow used by the MBARI (green color, 50cm in high). The 2/3 corer is filled.	No.30(MBARI)		
14:14	2605	0	297	leave the bottom			
14:21	2627	0	338	arrive to the bottom (st.13)			
14:25	2628	0	338	(st.13) get the serpetine flow used by the MBARI (red color(for Pf. Chiba-san), 50cm in high). The about 1/1 corer is filled (45cm).	No.31(MBARI)	18º-35.4002'N/ 146º-58.3282'E	X: -920.0 Y: -478.0
14:28	2628	0	337	leave the bottom			
14:29	2630	0	355	arrive to the bottom (st.14)			
14:30	2630	0	355	(st.14) get the serpentinite block by the arm, put in the box (D:#371-14R-01)	No. 32	18º-35.4891'N/ 146º-58.2645’E	X: -758.0 Y: -590.0
14:32	2630	0	355	(st.14) get the serpentinite block by the arm, put in the box (E:#371-14R-02)	No. 33		
14:33	2630	0	343	(st.14) get the serpentinite block by the arm, put in the box (A)	No. 34		
14:39	2630	0	343	(st.14) get the serpentine flow (carbonate concretion?) by the rake, put in the balck box (B:#371-14R-03)	No. 35(black box)		
14:40	2630	0	17	leave the bottom			
14:42	2631	2	31	sheeted serpentinite outcrop? (The End)			

Preliminary Results of KAIREI 7000II Dive #372

Dive No.	372		**Date**	2006/12/01
	Name		**Affiliation**	
English	Hisayoshi YOKOSE		Kumamoto University	
Japanese	横瀬 久芳		**Address**	
Speciality	Marine volcanology		2-39-1 Kurokami, Kumamoto 860-8555, Japan	
Theme	Internal structure of the serpentine seamounts			
Area	Big Blue Seamount			
Site	Big Blue East Ridge			
	Latitude	**Longitude**	**Time**	**Depth**
Landing	18º15.766'N	147º18.544’E	10:50	3498
Leaving	18º 16.3789'N	147º18.2274'E	14:38	3055
Cruising Distance	1300 m	**Deepest Point**	3498 m	
Dive Summary	In order to obtain geological information about the internal structure of a viscous serpentine flow, dive 372 was conducted submarine eastern flank of the Big Blue seamount on December 1, 2006. Dive 372 traversed 1.3 km north from the base of the eastern ridge of the Big Blue seamount (-3498 m) and up to the middle of the fault scarp (-3055 m).The Kaiko vehicle landed at a depth of -3498 m on a muddy slope with scattering small floats (serpentine). As we ascend the slope, talus became visible, and at -3445m, an outcrop of massive gabbro appeared. We observed that serpentine mud flow deposit drape the massive gabbro. At a depth of 3322 m, we encountered the first layered gabbro dipping north. After small outcrops of highly fractured metabasalt and gabbro, we saw a huge fault scarp appeared from -3265 m to -3076 m. The scarp mainly consists of bedded diabase dipping north. Metabasalt and gabbro are often intercarated with the diabase.At a depth of 3055 m, we collected final samples and left the bottom. Based on the collected samples and its occurences, the ridge seems to be a part of horst rather than interior of a viscous serpentine flow.			
Apparatus	Box, MBARI30, MBARI50, Rake			
Visual Records	TV1 2, TV2 2, TV3 2, Still 295			
Samples	Serpentine 5 Gabbro 6 Diabase 4	Metabasalt 5 Serpentine mud 1 MBARI 1	Mudstone 1	
Key Words	horst, gabbro, basalt, CCD			

Preliminary Results of KAIREI 7000II Dive #372

Summary of Results (For press)

Please write main three results of this dive.

1) The fault scrap is mainly composed of igneous rocks rather than a viscous serpentine flow.

2) Thin serpentine mud-flow mantled gentle slops.

3)

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1) The fault scrap is mainly composed of layered igneous rocks rather than a viscous serpentine flow.

The Big Blue seamount have been considered to be an accumulation of the serpentine mud flows (Fryer et al., 1999). However, major part of the dive track of #372 indicates coherently stratified layered igneous rocks, such as gabbro, diabase, and metabasalt.The lithology on the dive track is very similar to "horst" that have previously proposed by Johnson et al., (1991) . If we account for the ridge as a horst, total volume of the serpentine flows of the Big Blue seamount may be smaller than previously proposed.

---

2) Thin serpentine mud-flow mantled gentle slops.

It has been believed that a serpentine mud flow is a main constituent of a serpentine seamount and is coherently stratified like a stratovolcano (e.g. Freyer et al., 1999). Indeed many serpentine mud flows are observed around the summit regions of the Conical, South Chamorro, and Pacman seamounts using submersibles Alvine and Sinkai 6500. The thickness of the deposits is always less than ten meter. It is doubtful that thin mud flow deposits could produce a bell shaped mountain that has high aspect ratio. We observed thin serpentine mud flow on the track of #372 dive. The serpentine mud flow occurs on the gentle slope and overlies the basement rocks unconformly. The occurrence suggests that the mud flow may deposit relatively depressed surface area.So serpentine mud flows unlikely to produce a remarkable topographical high.

---

3)

Principal Investigater: Hisayoshi YOKOSE Dive#372

Preliminary Results of KAIREI 7000II Dive #372

Purpose and the progress of this dive

Main purpose of this dive

The purposes of this dive were twofold. The first is to combine geologic observations made during the dive with bathymetric analysis to better understand the structure and emplacement of the Big Blue seamount. The second purpose was to collect samples from a viscous serpentine flow, in order to determine their lithology and composition. This deep site potentially provides access to internal part of the Big Blue seamount, and thus may provide information regarding the growth history of the seamount.

Historical Review of Survey Area (References)

R/V Thomas G. Thompson cruise, January 31 to March 3, 1997, have confirmed that Big Blue Seamount is a serpentine seamount using piston and/or gravity core (Fryer et al., 1999). During YK03-07 cruise, the shallowest part of the Big Blue seamout was investigated by the Shinkai 6500. The result of the investigation were writen in the cruise report.

Pre-dive Survey

Bathymetric surevy was carried out by YK03-07 cruise.

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Preliminary Results of KAIREI 7000II Dive #372

Dive Result 1

1) Topography

The Big Blue seamount is the biggest one among the nine known serpentine seamounts on the Mariana forearc region (2150 km^2, 1380 km^3: assumed the base level = -3500 m). The shape is very complicated, probably because it has long growth history compared with the other serpentine seamounts. For example, three remarkable lineaments can be seen and cut the western flanks. There are seven small peaks. Some of them aligned parallel with the lineaments. Three truncated cone shaped peak,which have a crater, are located on the summit of the intact flow lobes. The pit craters may indicate the egress of a viscous serpentine flow and the lobe may express each flow direction. Because the thickness of the lobes are 100 m at lest, it is easy to delineate the outlines on the bathymetric map. There are some undulations on the surface of lobes as seen in a dacitic lava flow of a historical eruption. Each peak has a bell shaped profile and is very similar to a dacitic or rhyolitic lava dome. The similarity of the lobe shape implies that the physical properties of the both flows, lava and serpentine, may be essentially the same.

2) Geology

The Big Blue seamount have been considered to be an accumulation of the serpentine mud layers (Fryer et al., 1999). Major part of the dive track of #372 indicates coherently stratified layered igneous rocks, such as gabbro, diabase, and metabasalt. Serpentine mud flow, less than one meter, is only observed as draped sediment. Topographic similarities imply that whole eastern part of the Big Blue seamount is composed of the same lithology as observed from ROV KAIKO. Therefore, basement level could be reached to a depth of 2300 m. The lithology of the basement rocks is very similar to the horst (Johnson et al., 1991). Each effusive center of the Big Blue serpentine seamount is located on the western edge of the horst block.

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Preliminary Results of KAIKOU 7000II Dive #372

Dive Result 2

3) Biology

Many kinds of fishes and shrips were observed during the dive. Just before the end of the dive, we saw a red tiny anglerfish.

4) Others (Operation at sea floor)

Size of the sample basket is not enough for geological survy.

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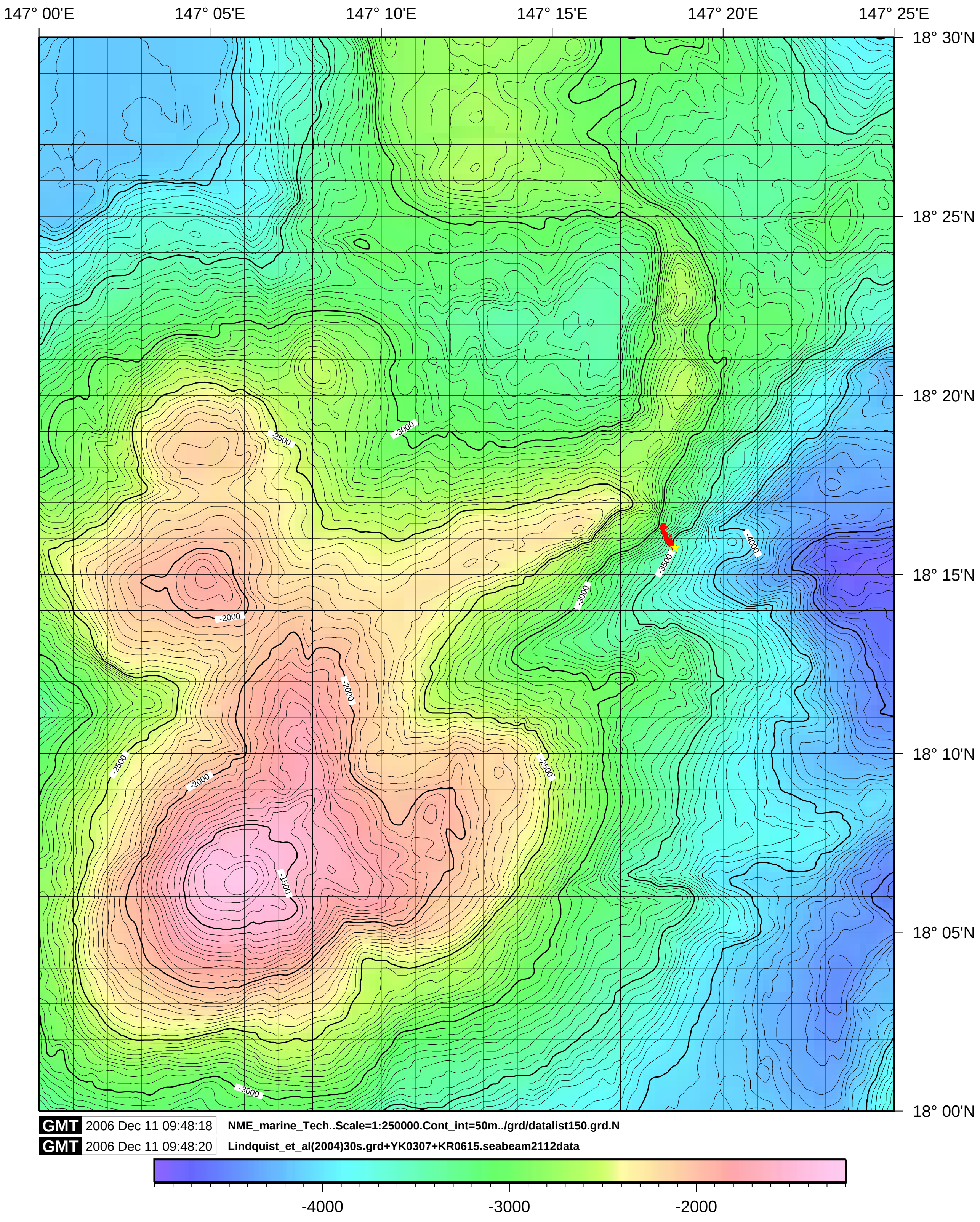
Preliminary Results of KAIREI 7000II Dive #372

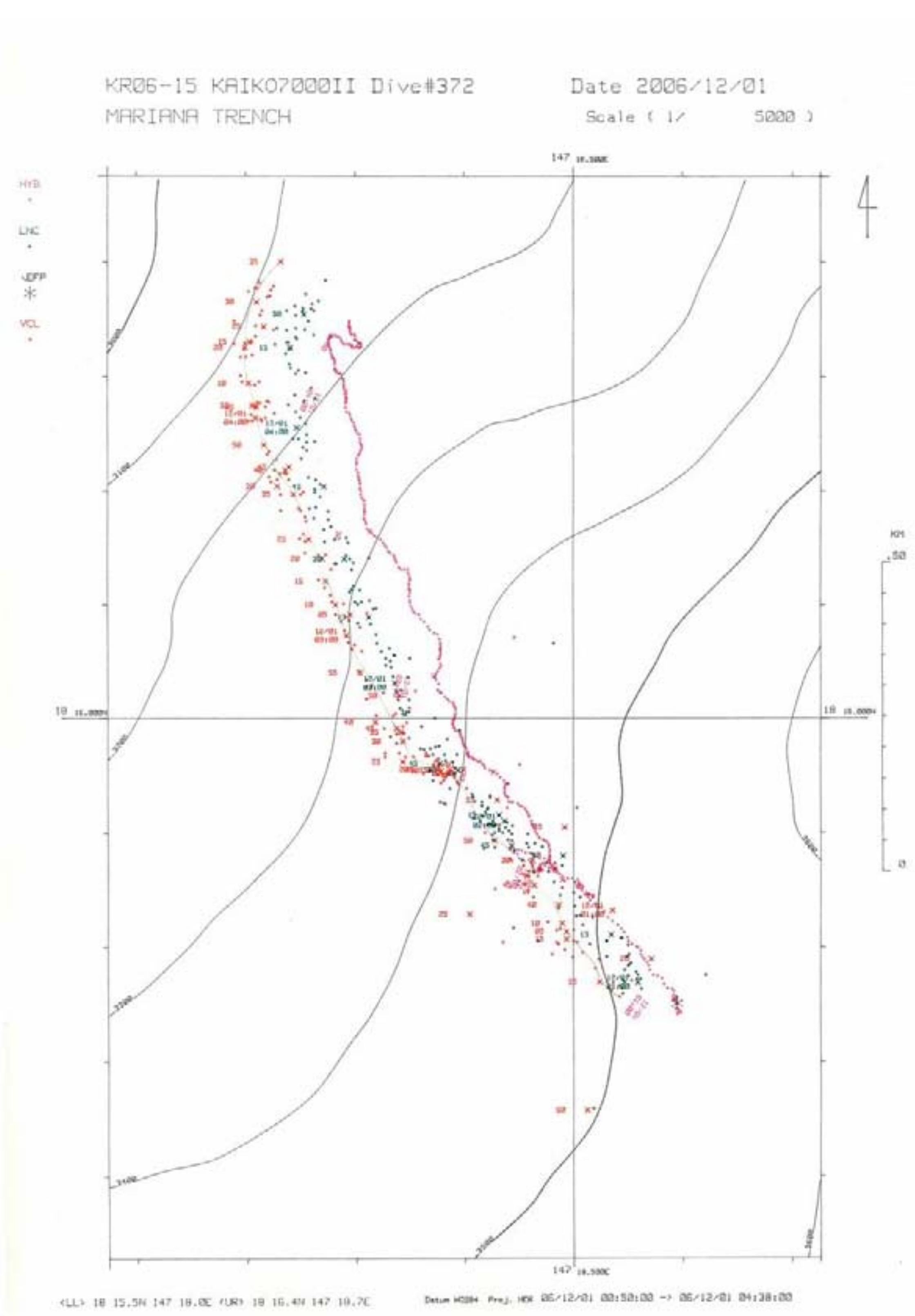
5 minutes highlight of each dive results

1)	11:23:00 ~ 11:23:30 Depth 3466 m TV 3 An outcrop of massive gabbro. 0:00:30
2)	11:30:00 ~ 11:30:30 Depth 3466 m TV3 An outcrop of massive gabbroic rock draped with serpentine mud flow. 0:00:30
3)	12:26:30 ~ 12:27:30 Depth 3340 m TV3 A normaly graded talus deposite 0:01:00
4)	12:31:30 ~ 12:32:00 Depth 3340 m TV3 An outcrop of massive gabbro 0:00:30
5)	12:41:10 ~ 12:41:40 Depth 3310 m TV3 An outcrop of layered diabase sheet 0:00:30
6)	14:04: 30 ~ !4:05:00 Depth 3113 m TV3 An outcrop of layered volcanic breccia. 0:00:30
7)	14:07:30 ~ 14:08:00 Depth 3103 m TV3 An outcrop of layered diabase 0:00:30
8)	14:27:00 ~ 14:28:00 Depth 3051 m TV3 A kind of angelfish. 0:01:00
9)	0:00:00
10)	0:00:00
11)	0:00:00
12)	0:00:00
13)	0:00:00
	Total Time: 05:00

Principal Investigater: Hisayoshi YOKOSE Dive#372

KR06-15.7K.Dive.372.BigBlue.SMT




KR06-15 KAIKO7000II Dive#372
Date 2006/12/01
MARIANA TRENCH
Scale (1/ 5000)
4
HYB
LNC
VDFP
VCL
147 18.500E
18 16.000N
KM
.50
0
<LL> 18 15.5N 147 18.0E <UR> 18 16.4N 147 18.7E
Datum WGS84 Proj. MER 06/12/01 00:50:00 -> 06/12/01 04:38:00

Dive Log of 7K Dive #372 Site Big Blue SMT 2006/12/01

Time (JST)	Dep. (m)	Alt. (m)	Head (Deg)	Description	Remarks	Latitude/ Longitude	
09:04				Landing on the water		18º-15.9964'N/ 147º-28.4526'E	
09:22				driving for the sea floor		18º-16.0825'N/ 147º-18.5213'E	X: 613.3 Y: -138.7
09:48	1000			launcher depth: 1000m, driving for the sea floor			
10:05	2000			launcher depth: 2000m, driving for the sea floor			
10:12	2500			launcher depth: 2500m, driving for the sea floor			
10:19	3000			launcher depth: 3000m, driving for the sea floor			
10:31	3363			arrive at the leaving point			
10:35	3363	123	90	leave the vehicle		18º-15.7399'N/ 147º-18.5622'E	X: -18.7 Y: -66.7
10:47	3481	17	323	direction (320^{o}), strong sonar response			
10:49	3494	5	326	visible on the bottom			
10:50	3498	0	286	arrive to the sea bottom		18º-15.7666'N/ 147º-18.5444'E	X: 30.7 Y: -98.0
10:50	3498	0	286	(st.1) talus, and getting the samples by the arm, and put on the F (#372-01R-01)	No.1		
10:52	3498	0	286	(st.1) getting one more sample by the arm, and put on the F (#372-01R-02)	No.2		
10:54	3497	2	322	current ripple, muddy bottom			
10:55	3497	2	329	mud with float on the bottom			
10:55	3497	2	329	a fish			
10:57	3490	3	327	glassy sponge and a fish			
10:58	3490	2	332	many holes on the muddy bottom			
11:00	3493	0	329	mud with many 5-7cm angular pebbles			
11:03	3488	3	320	talus, increasing the pebbles, and partly breaking up			
11:05	3486	6	294	mud with many 10-20cm angular to sub angular pebbles			
11:06	3487	2	284	(st.2) talus outcrop, getting the angular 12cm long sample by the arm, putting on the D (#372-02R-01)	No.3	18º-15.8089’N/ 147º-18.4922’E	X: 108.7 Y: 190.0
11:06	3487	2	284	(st.2) talus outcrop, getting the angular 15cm long sample by the arm, putting on the D (#372-02R-02)	No.4		
11:10	3487	2	284	(st.2) talus outcrop, getting the square-shaped 12cm long sample by the arm, putting on the D (#372-02R-03)	No.5		
11:13	3487	2	284	rake sample is canceled, because of hard bottom for the rake sampling			
11:14	3487	0	285	near the st.2 outcrop, the bottom is hard checked by the arm pushing			
11:17	3478	4	330	mud with <5cm sub angular to sub rounded pebbles on the bottom			
11:18	3467	4	329	talus, mud with 5-15cm sub angular pebbles on the bottom			
11:18	3467	4	329	sea chestnut			
11:19	3467	4	329	a fish and many holes			
11:20	3456	5	332	talus but secondary deposit, mud with 10-20cm angular pebbles on the bottom			
11:21	3445	5	333	there are many angular and decreasing the muddy sediment (secondary deposit), and partly breaking up			
11:25	3436	2	308	(st.3) outcrop (serpentinite) weakly foliated, getting the square-shaped 15cm long sample by the arm, putting on the E (#372-03R-01)	No. 6	18º-15.8631'N/ 147º-18.4631’E	X: 208.7 Y: -241.3
11:27	3436	3	309	(st.3) getting the sub rounded 10cm long sample partly reddish colored by the arm, putting on the E (#372-03R-02)	No. 7		
11:28	3434	4	342	(st.4) serpentinite outcrop, platy and weakly foliated serpentinite,. Partly horizontal serpentinite clay, getting the sheared serpentinite (10cm large) and putting on the BOX			
11:35	3434	4	342	(st.4) getting the sheared serpentinite (15cm large) and putting on the BOX			
11:43	3434	3	347	(st.4) getting the sheared serpentine core by MBARI (blue color, 30 cm). The corer is filled with about 15cm sample.	No.8	18º-15.8631'N/ 147º-18.4631’E	X: 208.7 Y: -241.3
11:43	3434	3	355	Appendix sheared serpentinite samples in the BOX (about 18cm long)			
11:47	3419	3	325	mud with 5-20cm sub angular to sub rounded pebbles on the bottom			
11:48	3407	3	326	mud with 10-30cm sub angular pebbles on the bottom, mainly floats			
11:49	3401	3	328	mud with <5cm sub rounded pebbles on the bottom, partly sticking out the big (<50cm) serpentinite block			
11:50	3393	4	325	mud with 10-20cm platy pebbles on the bottom			
11:51	3382	7	332	mud with <5cm sub rounded pebbles on the bottom, partly sticking out the big (<30cm) serpentinite block			

Dive Log of 7K Dive #372 Site Big Blue SMT 2006/12/01

Time (JST)	Dep. (m)	Alt. (m)	Head (Deg)	Description	Remarks	Latitude/ Longitude	
11:53	3374	3	336	many holes			
11:53	3372	3	326	mud with <5cm sub rounded pebbles on the bottom			
11:54	3367	3	320	mud with >50cm large float			
11:54	3362	3	319	mud with 10-30cm sub angular to sub rounded pebbles on the bottom			
11:56	3360	3	335	mud with 5-10cm sub angular pebbles on the bottom, partly sticking out the big (<50cm) serpentinite block			
11:57	3359	3	331	ridge topography, and the top are <30cm large serpentinite blocks			
12:01	3355	5	323	mud with >150cm large float on the bottom, and partly broken up			
12:10	3362	1	278	(st. 5) several outcrops of 100-150cm large. partly breaking up, and broken samples are mainly sub rounded.			
12:12	3362	2	279	(st. 5) 15 cm large serpentinite block to E (#372-05R-01)	No.9	18º-15.9643'N/ 147º-18.3798'E	X: 395.3 Y: -338.0
12:14	3362	1	278	(st. 5) 10 cm large serpentinite block to E (#372-05R-02)	No.10		
12:17	3361	4	300	mud with 5-20cm sub angular to sub rounded pebbles on the bottom			
12:18	3353	6	300	about 100cm size floats and 5-20 cm sub angular pebbles			
12:23	3341	6	305	several 1.5-2 m large outcrops			
12:25	3338	5	322	mud with angular pebbles with a white fish			
12:26	3338	5	329	beautiful outcrops of talus			
12:27	3340	5	334	30-60 cm angular			
12:30	3341	5	326	Genge (fish)			
12:33	3340	4	319	(st. 6) >3m large serpentinite outcrops with angular pebbles on the bottom. 15 cm large serpentinite block to E (#372-06R-01)	No.11	18º-15.9849'N/ 147º-18.3484'E	X: 433.3 Y: -443.3
12:33	3340	4	319	(st. 6) >3m large serpentinite outcrops with angular pebbles on the bottom. Two 15 cm large serpentinite blocks to E (larger sample is putting on D (#372-06R-02,#372-06R-03))	No.12,13		
12:35	3338	4	323	large serpentinite outcrop (about W3m × H>4m)			
12:36	3332	4	323	mud with 10cm long angular pebbles			
12:37	3329	3	330	mud with 10cm long angular pebbles and partly sticking the serpentinite blocks (<50cm)			
12:38	3322	6	324	large serpentinite outcrop, massive and weakly foliated			
12:39	3317	3	327	large serpentinite outcrop, massive but foliated			
12:40	3311	6	327	large serpentinite outcrop (more than 5m × 5m), massive			
12:41	3310	6	324	large serpentinite outcrop, showing lamellae			
12:42	3309	5	338	brecciated serpentinite and angular-shape (mainly small breccia)			
12:44	3295	6	334	brecciated serpentinite and angular-shape (mainly 10- 30cm breccia)			
12:49	3293	3	311	(st.7) outcrop with red shrimp. getting the platy 20cm long sample, putting on the E (#372-07R-01)	No. 14	18º-16.0175'N/ 147º-18.3257'E	X: 493.3 Y: -483.3
12:50	3291	5	335	large serpentinite outcrop, massive and partly brecciated			
12:51	3288	4	326	serpentinite outcrop, many platy angular pebbles (20-60cm)			
12:51	3284	3	342	serpentinite outcrop, many platy angular pebbles (<15cm)			
12:53	3279	4	320	outcrop, massive serpentinite,			
12:53	3278	3	325	over the valley			
12:53	3278	3	325	talus, sub rounded 10-20cm large pebbles			
12:54	3277	2	329	outcrop, massive serpentinite, and weakly sheared			
12:56	3275	4	328	outcrop (W3 × 3m) , massive serpentinite and weakly brecciated			
12:57	3270	4	327	talus, platy 20-40cm long			
12:58	3268	5	346	serpentinite outcrops, >50cm large,			
12:59	3265	2	328	mud only			
13:02	3265	3	327	mud bottom with sub angular to sub rounded pebbles, and sometimes sticking out the big (50-100cm) serpentinite block			
13:04	3266	3	324	brecciated serpentinite, float			
13:05	3264	5	332	float, sub angular and 2m large			
13:07	3262	3	308	sea cucumber and many holes			
13:07	3260	2	324	about 10cm long, and sub rounded pebbles			
13:09	3261	1	324	muddy bottom			
13:11	3263	2	326	float, sub angular and 1-2m large on the bottom			
13:14	3266	2	330	talus, sub angular and 10-40cm large, rarely >50cm on the bottom			
13:15	3266	2	321	platy, >50cm long samples on the bottom			
13:17	3265	2	320	partly broken serpentinite float			
13:17	3264	3	323	2m large serpentinite float			
13:18	3262	6	326	angular 20cm long pebbles on the bottom			
				□(increasing angular float)			
13:21	3255	2	326	angular to sub angular 10-30cm long pebbles on the bottom			

Dive Log of 7K Dive #372 Site Big Blue SMT 2006/12/01

Time (JST)	Dep. (m)	Alt. (m)	Head (Deg)	Description	Remarks	Latitude/ Longitude	
13:23	3250	1	314	angular to sub angular 10-20cm long pebbles on the bottom			
13:24	3245	1	330	platy 10cm long pebbles, sometimes <50cm blocks			
13:26	3142	3	322	sub angular <15cm long pebbles on the bottom			
13:28	3239	4	327	sub angular 10-40cm long pebbles on the bottom			
13:29	3234	4	341	platy 20-40cm long pebbles, and partly brecciated			
13:31	3231	3	328	platy 15-40cm long pebbles, and partly brecciated			
13:33	3225	3	318	angular to sub angular 5-25cm long pebbles, and partly brecciated			
13:34	3220	3	327	serpentinite outcrops. angular and 20-60cm large. And 10-20cm long angular on the bottom			
13:36	3216	3	338	talus, mainly 10cm size sub rounded to sub angular pebbles, sometimes broken serpentinite blocks.			
13:38	3210	3	325	talus, mainly 10cm size sub rounded to sub angular pebbles, sometimes broken serpentinite blocks (and >50cm long).			
13:43	3202	3	326	(st.8) talus, 10-30cm angular serpentinite pebbles. Getting the platy 13cm long samples and putting on D (#372-08R-01).	No.15	18º-16.2235'N/ 147º-18.2368'E	X: 873.3 Y: -640.0
13:43	3202	2	325	(st.8) Getting the platy 5cm long serpentinite samples and putting on D (#372-08R-02)	No.16		
13:45	3200	4	330	talus, <15cm size sub rounded to sub angular pebbles on the bottom			
13:46	3192	4	331	talus, <40cm size sub rounded to sub angular pebbles on the bottom			
13:47	3187	4	324	talus, <15cm size sub angular pebbles on the bottom			
13:47	3180	5	328	talus, <15cm size sub rounded pebbles on the bottom, and there are several grain-flows			
13:48	3174	3	327	talus, <15cm size sub rounded pebbles on the bottom			
				□(decreasing the pebble size)			
13:49	3169	5	342	talus, fine-grained(<5cm size) sub rounded pebbles on the bottom			
13:50	3163	6	329	talus, <50cm size sub rounded pebbles on the bottom, and grain flow.			
13:51	3154	4	333	serpentinite horseback, grain-flow, steep wall			
13:52	3148	5	330	several ridges and valleys are recognized on the sonar			
13:52	3147	3	335	(st.9) serpentinite outcrops, sheared serpentinite, many fracture zone. This outcrop continues from this point to leaving point (more than 98m height)			
13:59	3141	4	311	(st.9) getting the brecciated and angular (<3cm size)) serpentinite sample. putting on the C (small 1 sample) (#372-09R-01)	No.17	18º-16.2777'N/ 147º-18.2179'E	X: 973.3 Y: -673.3
13:59	3141	4	311	(st.9) getting the brecciated and angular (<3cm size)) serpentinite sample putting on the C (small 2 samples) (#372-09R-02)	No.18		
14:03	3131	8	308	serpentinite outcrop, weakly foliated, partly grain flows. Crack interval is about 5-7cm and going to the top crack is increasing.			
14:07	3113	8	297	a bonefish			
14:08	3103	6	326	outcrop continues			
14:09	3090	10	337	partly foliated serpentinite, foliate interval is about 10cm			
14:10	3079	10	332	serpentinite outcrops, Mn-coating area is small. Steep wall side is wide crack interval, and horizontal platy surface is narrow crack interval.			
14:13	3079	8	344	serpentinite outcrop, and almost vertical crack are dominant, and Mm-coating is rare.			
14:17	3067	4	298	(st.10) serpentinite outcrops, fractured, and mainly 5-7cm size pebbles. getting the angular and 7cm long sample by the arm .putting on A (1 sample) (#372-10R-01)	No.19	18º-16.3427'N/ 147º-18.1952'E	X: 1093.3 Y: -713.3
14:20	3067	4	298	(st.10) getting the angular and 5cm long sample by the arm. putting on A (2 samples) (#372-10R-02)	No.20,21		
14:21	3065	8	0	serpentinite outcrop, fractured and almost vertical cracks are dominant. There are many slickenside (<20^{o})			
14:23	3049	10	355	serpentinite outcrop, highly sheared and no Mn-coating			
14:28	3051	7	339	a red fish (angler?)		18º-16.3554'N/ 147º-18.2198’E	X: 1116.7 Y: -670.0
14:34	3055	3	249	(st.11) serpentinite outcrop, almost horizontal crack are dominant.			
14:35	3054	6	250	(st.11) getting the brecciated and angular serpentinite sample putting on the D (1 sample) (#372-11R-01)	No.22	18º-16.3789'N/ 147º-18.2274'E	X: 1160.0 Y: -656.7
14:35	3054	6	250	(st.11) getting the brecciated and angular serpentinite sample putting on the A (1 sample) (#372-11R-02)	No.23		
14:37	3054	6	250	(st.11) getting the brecciated and angular serpentinite sample putting on the D (25cm size, 1 sample) (#372-11R-03)	No.24		
14:38	3054	6	357	leave the bottom			
15:56				surfacing		18º-16.5151'N/ 147º-18.9110'E	

Preliminary Results of KAIREI 7000II Dive #373

Dive No.	373	Date	2006/12/02

	Name	Affiliation
English	Hirokazu MAEKAWA	Osaka Prefecture University
Japanese	前川　寛和	Address
Speciality	Metamorphic petrology	1-1, Gakuen-cho, Naka-ku, Sakai, Osaka 599-8531, Japan

Theme	Geologic reconnaissance of the Unknown 1 Seamount
Area	Mariana Trench
Site	Unknown 1 Seamount

	Latitude	Longitude	Time	Depth
Landing	17º53.3799'N	147º28.7094'E	10:48	3736
Leaving	17º53.6202'N	147º28.2470'E	14:32	3314

Cruising Distance	1.3 km	Deepest Point	3736 m

Dive Summary	Dive #373 was conducted at the steep slope of northeastern side of Unknown 1 Seamount near trench to obtain geological information about the internal structure of the seamount. The Kaiko 7000II vehicle landed at a depth of -3736 m on rocky but relatively flat floor, which is composed of highly fractured basaltic rocks and is partly covered with muddy brownish sediments (St. 1). In the area from St. 1 to St.9 (-3578 m), main view is muddy floor with ripple marks. Outcrops of highly fractured basalt or aggregates of cobble-sized basalt are often observed. Serpentinized peridotites are relatively rare. After the region where fragmented basalt is predominant, fault scarps of boulder to cobble-ized rocks appeared from St. 10. (-3572 m) to the leaving point, St. 15 (-3314m). The rocks obtained are gabbro, basalt (including pillow lava), serpentinite, and minor chert. From a depth of -3500 m to St. 15, layered sequences of sheared serpentinite with peridotite blocks, gabbro, and basalt are observed. we collected final samples at St. 15 and left the bottom. Taking account of predominance of igneous rocks, the seamount is considered to be not a serpentinite seamount like Conical and South Chamorro Seamounts, but a horst block of a part of oceanic crust.
Apparatus	Box, MBARI30 x 2, MBARI50 x 2, Rake
Visual Records	TV1 2, TV2 2, TV3 2, Still 189
Samples	Serpentinized peridotite 7 Basaltic tuff 1 Breccia 2 Gabbro 5 Basalt 13 Chert 2 MBARI 4
Key Words	horst, gabbro, basalt, peridotite

Principal Investigater: Hirokazu MAEKAWA Dive#373

Preliminary Results of KAIREI 7000II Dive #373

Summary of Results (For press)

Please write main three results of this dive.

1) Observation of internal structure of forearc seamount near trench.

2) Sampling of constituent rocks.

3) MBARI sampling at the serpentine layer.

1) Observation of internal structure of forearc seamount near trench.

We set the dive #373 course a traverse of north eastern steep wall of Unknown 1 Seamount to elucidate the internal structure of the seamount. The recovered rocks are basalt, basaltic tuff, gabbro, serpentine mud materials with fragments of serpentinized peridotite, and chert. From -3736 m to -3600 m in depth, basaltic rocks are predominant, whereas in the area shallower than -3572m, gabbroic rocks are partly exposed. Serpentinite or serpentinized peridotite is sporadically exposed, but seems to be subordinate. As the most of outcrops are covered with cobble-sized floats, making it difficult to decide rock types in each outcrops. It is, however, highly probable that within the depths covered in this dive the seamount has layered sequence, i.e., basaltic rocks are predominant in the area deeper than -3600 m, and gabbroic rocks are predominant in the shallower area.

2) Sampling of constituent rocks.

Thirty rock samples were recovered during the dive #373, that is, 7 serpentinized peridotites, 5 gabbros, 13 basalts and their equivalents 14, and 2 cherts.

3) MBARI sampling at the serpentine layer.

Four MBARI cores were successfully sampled from muddy serpentine layers with black serpentinite fragments.

Principal Investigater: Hirokazu MAEKAWA Dive#373

Preliminary Results of KAIREI 7000II Dive #373

Purpose and the progress of this dive

Main purpose of this dive

The main purpose of this dive is to elucidate the origin and formation process of the near-trench forearc seamount. We must combine geologic observations with bathymetric analysis to understand the structure of the seamount. The second purpose was to collect samples from constituents of the seamount to determine their lithologies and compositions.

Historical Review of Survey Area (References)

The relief of the seamount are recognized in the previous bathymetric map of Fryer et al. (1999) and Scientific shipboard party (2001). The Unknown 1 Seamount, however, has never been introduced in any journals and publications.

Pre-dive Survey

Single line of multi-narrow beam bathymetric survay with SEA BEAM 2112 plus side scan sonar mode was carried out before the dive #371.

Principal Investigater: Hirokazu MAEKAWA Dive#373

Preliminary Results of KAIREI 7000II Dive #373

Dive Result 1

1) Topography

Unknown 1 Seamount is a seamount elongated in the N-S direction approximately parallel to the Mariana Trench. Faults developed in the direction of NNW-SSE and N-S largely affect the shape of the seamount. The dive #373 was conducted at the steep cliff cut by a N-S trending large fault. We expected to see internal structure of the seamount and obtain constituent rocks during this dive, and successfully could observe layered sequence of igneous varieties and got many constituents rocks from the continueous exposures of the cliff.

2) Geology

The dive #373 was conducted at the north eastern steep wall of Unknown 1 Seamount to elucidate the internal structure of the seamount. The recovered rocks are basalt, basaltic tuff, gabbro, serpentine mud materials with fragments of serpentinized peridotite, and chert. From -3736 m to -3600 m in depth, basaltic rocks are predominant, whereas in the area shallower than -3572m, gabbroic rocks are partly exposed. Serpentinite or serpentinized peridotite is sporadically exposed, but seems to be subordinate. Similar to the east ridge of Big Blue Seamount investigated in dive #372, serpentine mud flow less than a few meter is only observed as a draped sediment. As the most of outcrops are covered with cobble-sized floats, making it difficult to decide rock types in each outcrops. It is, however, highly probable that within the depths covered in this dive the seamount has layered sequence, i.e., basaltic rocks are predominant in the area deeper than -3600 m, and gabbroic rocks are predominant in the shallower area.

The constituent rocks and the shape of the seamount suggest that Unknown 1 Seamount has different origin from cone-shaped seamount, such as Conical and South Chamorro Seamounts. It is probably a horst block surrounded by faults, as suggested by Fryer et al. (1999).

Principal Investigater: Hirokazu MAEKAWA Dive#373

Preliminary Results of KAIKOU 7000II Dive #373

Dive Result 2

3) Biology

Reddish shrimp, starfish, and fish were sometimes observed during the dive.

4) Others (Operation at sea floor)

MBARI core sampling

Principal Investigater: Hirokazu MAEKAWA Dive#373

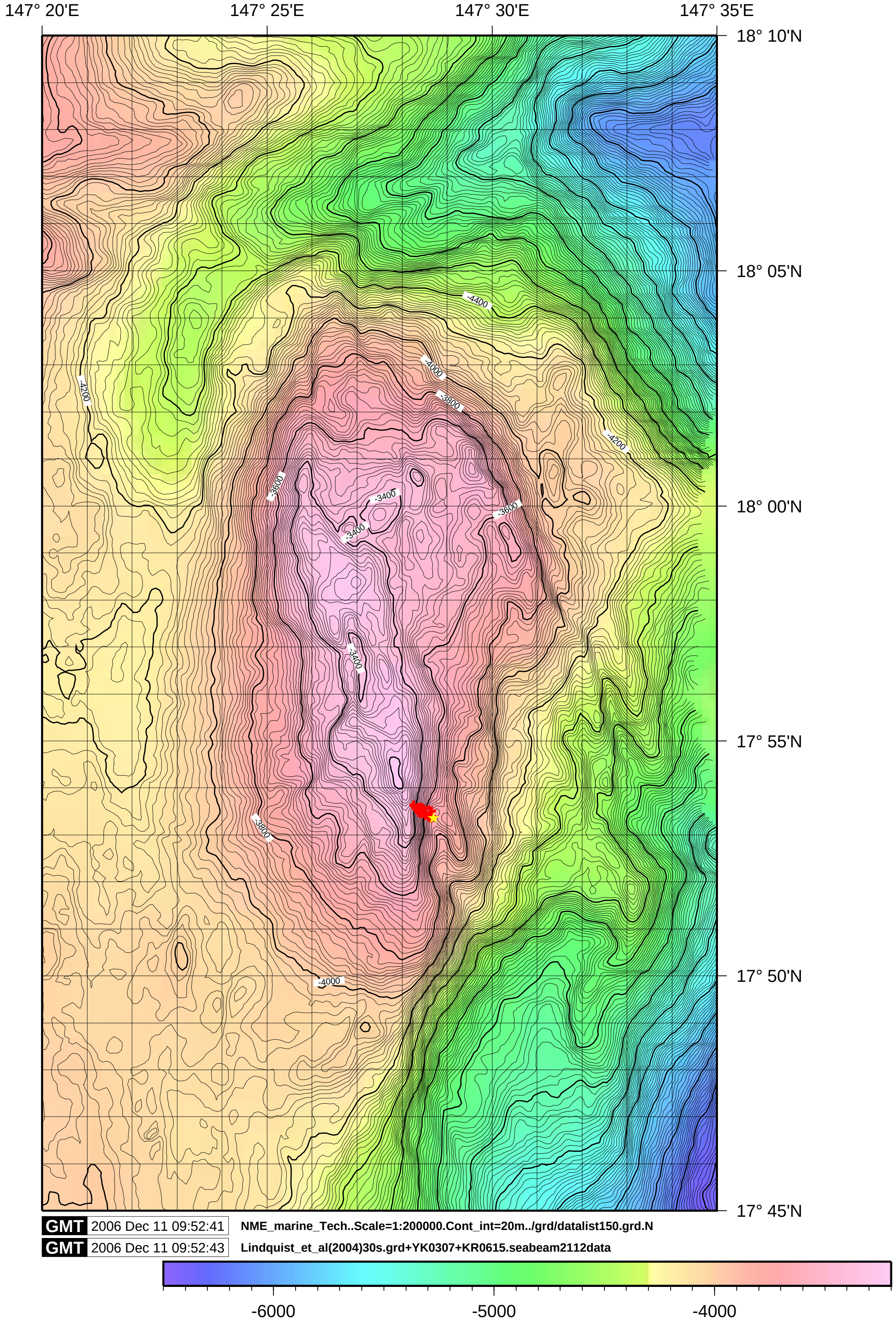
Preliminary Results of KAIREI 7000II Dive #373

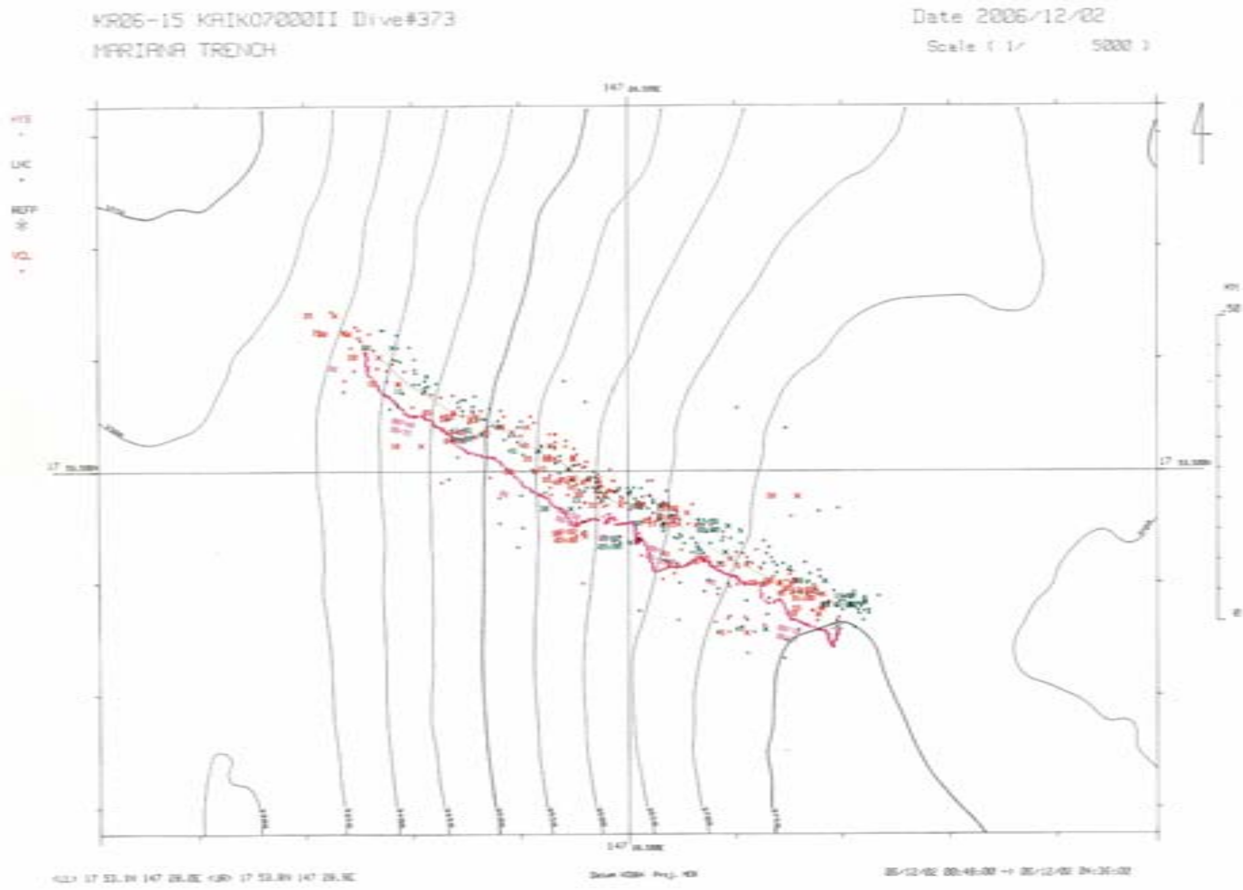
5 minutes highlight of each dive results

1)	10:50:50 ~ 10:52:00 Depth 3736 m TV 3 A small exposure of basalts (Station 1). 0:01:10
2)	11:08:40 ~ 11:09:25 Depth 3746 m TV 3 Starfish resting on the surface of a basalt block (Station 2) 0:00:45
3)	12:37:40 ~ 12:38:20 Depth 3577 m TV 1 Serpentine mud layer (Station 9). 0:00:40
4)	12:52:45 ~ 12:53:35 Depth 3109 m TV 3 Basalt and gabbro at the slope of (Station 10). 0:00:50
5)	13:38:05 ~ 13:38:40 Depth 3107 m TV 3 Gabbro, serpentinite, and chert were obtained (Station 12). 0:00:35
6)	13:49:35 ~ 13:50:35 Depth 3457 m TV 3 Wide Wide exposures of serpentine mud with pebble- to cobble-sized serpentine fragments (Station 13). 0:01:00
7)	0:00:00
8)	0:00:00
9)	0:00:00
10)	0:00:00
11)	0:00:00
12)	0:00:00
13)	0:00:00
	Total Time: 05:50

Principal Investigater: Hirokazu MAEKAWA Dive#373

KR06-15.7K.Dive.373.potato.SMT




KR06-15 KAIKO7000II Dive#373
MARIANA TRENCH
Date 2006/12/02
Scale (1/ 5000)
147
17
147
HYS
LHC
VCL
4
50
0

Dive Log of 7K Dive #373 Site Unknown 1 Seamount 2006/12/02

Time (JST)	Dep. (m)	Alt. (m)	Head (Deg)	Description	Remarks	Latitude/ Longitude	
10:36	3607	123	96	leave the vehicle		17º-53.3889'N/ 147º-28.7000'E	
10:46	3726	6	307	visible on the bottom, current ripple, mud		17º-53.3799’N/ 147º-28.7094’E	
10:48	3736	0	321	(st.1) arrive to the bottom	No.1 (rock1)	17º-53.3799'N/ 147º-28.7094'E	
10:51	3737	0	331	(st.1) get the block (basaltic?) by the arm, put in the box (F:#373-01R-01)			
10:54	3737	0	334	(st.1) get the block (basaltic?) by the arm, put in the box (F:#373-01R-02)	No.2 (rock2)		
10:56	3737	0	329	(st.1) get the block (basaltic?) by the arm, put in the box (F:#373-01R-0)	No.3 (rock3)		
10:57	3737	0	300	leave the bottom			
10:59	3743	2	314	ripple, large block (<1m) on the bottom		17º-53.3907'N/ 147º-28.6811'E	
11:03	3746	1	292	shrimp			
11:05	3736	1	307	gravels strat to increase			
11:08	3746	0	291	(st.2) arrive to the bottom, starfish, get the serpentinite block by the arm, put in the box (F:#373-02R-01)	No.4 (rock4)	17º-53.3925'N/ 147º-28.6509'E	
11:13	3746	0	291	(st.2) get the peridotite block (large) by the arm, put in the box (F:#373-02R-02)	No.5 (rock5) same rock4		
11:14	3746	3	285	leave the bottom			
11:15	3743	2	300	up to slope, many pebble on the bottom			
11:16	3744	0	291	(st.3) arrive to the bottom, debris fan, get the serpentinite blocks by the rake, put in the black box (B)	No.6 (rake1)	17º-53.2124'N/ 147º-28.6509'E	
11:21	3743	0	294	(st.3) get the rock samples (white) by the arm, put in the box (F#373-03R-01,#373-03R-02,#373-03R-03)	No.7-9 (rock6-8)		
11:25	3743	2	295	leave the bottom			
11:28	3736	1	311	(st.4) arrive to the bottom, get the rock sample (white, muds) by the arm, put in the box (F:#373-04R-01)	No.10 (rock9)		
11:30	3735	1	303	(st.4) get the rock sample (black, basaltic?) by the arm, put in the box (E:#373-04R-02)	No.11 (rock10)	17º-53.4142'N/ 147º-28.6377’E	
11:33	3735	3	294	leave the bottom			
11:35	3721	2	296	large serpentinite block (<2m)			
11:37	3713	2	294	(st.5) arrive to the bottom, many gravels, get the two rock samples by the rake, put in the box (C)	No.12 (rake2)	17º-53.4233'N/ 147º-28.6113'E	
11:48	3712	3	299	leave the bottom			
11:50	3678	4	300	serpented mud flow			
11:56	3657	2	284	(st.6) arrive to the bottom, get many small gravels samples with mud by the rake, put in the box	No.13(rake3)	17º-53.4504'N/ 147º-28.5716’E	
12:00	3658	3	284	leave the bottom			
12:03	3645	2	290	serpented mud flow			
12:06	3630	5	282	look like Conical and S Chamorro,but more gravels			
12:12	3621	2	354	(st.7) arrive to the bottom, get three gravel samples by the arm, put in the box (A:#373-07R-01,#373-07R-02,#373-07R-03)	No.14-16 (rock11-13)	17º-53.4128'N/ 147º-28.5401'E	
12:17	3621	2	348	leave the bottom			
12:22	3600	2	313	(st.8) arrive to the bottom, get two gravel samples by the arm, put in the box (A:#373-08R-01,#373-08R-02,#373-08R-03)	No.17,18 (rocks14,15)	17º-53.4276'N/ 147º-28.5226’E	
12:26	3598	3	297	leave the bottom			
12:38	3578	2	288	(st.9) get the serpentine muds used by MBARI (blue, 30cm in high). The 1/2 corer is filled.	No.19(core1)	17º-53.4400'N/ 147º-28.5129'E	
12:48	3578	2	288	(st.9) get the serpentine muds used by MBARI (red, 50cm in high). The 1/2 corer is filled.	No.20(core2)		
12:50	3578	2	297	leave the bottom			
12:51	3574	5	306	big serpentinite mud block(<2m)			
12:52	3572	2	295	(st.10) arrive to the bottom, get four gravel samples by the arm, put in the box (E:#373-10R-01,#373-10R-02,#373-10R-03,#373-10R-04)	No.21-24(rock16-19)	17º-53.4533'N/ 147º-28.4773'E	
13:00	3572	4	296	leave the bottom			
13:10	3556	1	290	(st.11) arrive to the bottom, get the serpentine muds (white-gray) by the rake, put in the black box	No.25 (rake4)	17º-53.5064'N/ 147º-28.4452'E	
13:16	3556	1	285	(st.11) get the serpentine muds (white-gray) used by MBARI (green, 50cm in high). The 1/3 corer is filled.	No.26 (core3)		

Time (JST)	Dep. (m)	Alt. (m)	Head (Deg)	Description	Remarks	Latitude/ Longitude	
13:22	3556	2	308	leave the bottom			
13:34	3520	3	317	(st.12) arrive to the bottom, get the mud block sample (white) by the arm, put in the box (E:#373-12R-01)	No.27 (rock20)	17º-53.5371'N/ 147º-28.4131'E	
13:39	3519	3	319	(st.12) get three rock samples (two angular-subangular, one relatively rounded) by the arm, put in the box (E:#373-12R-02,#373-12R-03,#373-12R-04)	No.28-30 (rock21-23)		
13:41	3519	3	291	leave the bottom			
13:43	3506	6	273	layered outcrop (about 3m high), serpentine flow?			
13:47	3475	4	296	layered serpentine mud outcrop, scarp, shear zone (between 3454-3475m)			
13:51	3454	3	276	(st.13) arrive to the top of outcrop, get the serpentine muds used by MBARI (black, 30cm in high). The 1/2 corer is filled.	No.31 (core4)	17º-53.5498'N/ 147º-28.3546'E	
14:01	3454	3	305	(st.13) get the serpentinite mud block by the arm, put in the box (A:#373-13R-01)	No.32 (rock24)		
14:01	3450	5	284	leave the bottom			
14:06	3414	2	287	ripple, lobe			
14:09	3392	3	302	(st.14) arrive to the bottom, get three rock samples by the arm, put in the box (C:#373-14R-01,#373-14R-02,#373-14R-03)	No.33-35 (rock25-27)	17º-53.5678'N/ 147º-28.3187'E	
14:13	3391	3	300	leave the bottom			
14:25	3314	0	305	(st.15) arrive to the bottom, get two rock samples by the arm, put in the box (E:#373-15R-01,#373-15R-02)	No.36,37 (rock28-29)	17º-53.6202'N/ 147º-28.2470'E	
14:30	3314	2	306	set a marker "KAIKO7000II #373" on the floor!!			
14:32	3314	2	305	leave the bottom (Finish)			

Preliminary Results of KAIREI 7000II Dive #374

Dive No.	374	**Date**	2006/12/03

	Name	**Affiliation**
English	Kantaro FUJIOKA	Senior Scientist JAMSTEC/IFREE
Japanese	藤岡　換太郎	**Address**
Speciality	Marine Geology	3173-25, Showa-Machi, Kanazawa-Ku Yokohama City, Kanagawa 236-0001 Japan

Theme	General overview of the Turquoise Seamount
Area	Turqoise Seamount
Site	Near the summit area

	Latitude	**Longitude**	**Time**	**Depth**
Landing	16º56.9863’ N	147º10.2628’ E	10:36	3305
Leaving	16º57.5133’ N	147º10.5528’ E	13:41	3196

Cruising Distance	1000 m	**Deepest Point**	3307 m

Dive Summary

A short traverse of the southern wall of the proposed north-south ship’s track across the summit area of the Turquoise Seamount, Mariana forearc was performed unsuccessfully, because the rough sea condition killed the time available but the followings are the most notable geological aspects of the regions attained;

(1) Lithology of the south facing upper slope of the Turquoise Seamount is divided mainly into the following two units: Pelagic to Hemipelagic mud with carbonate (Foraminifers) turbidite, serpentine-mud flow deposit with various kind of rocks both are covered with thick manganese coating sometime up to 8 mm to 1 cm. The surface of the sediments show a remarkable ripple marks and scattered pebbles and cobbles of serpentinites.

(2) Small remnant mound, actually ridge of an old serpentine-mud flow appear on the sediment surface which consist mostly of pebbles and cobbles.

(3) A platy hard sediment covered with thick manganese forming deformed slab like structure are seen in some outcrop. Minor topography shows a combination of small ridge and rather gentle sedimented flat plain.

(4) A fat fish swimming toward the Kaiko 7000 II and collided with blue handle of the MBARI corer then swam away rapidly.

(5) Notable fossil trails are seen on the soft sediment surface. They are the structures caused by the sea urchin.

(6) Two small, 10 cm diameter, 10 cm height with summit pit crater about 3 cm diameter, mud volcanoes were encountered. They are composed of soft white mud, may be mixture of Hemipelagic mud and serpentine-mud and seem to erupt recently.

Apparatus	Box, MBARI30, MBARI50, Rake
Visual Records	TV1 2, TV2 2, TV3 2, Still 123
Samples	Rocks 28, Cores 2, Kumade
Key Words	horst, gabbro, basalt, CCD

Preliminary Results of KAIREI 7000II Dive #374

Summary of Results (For press)

Please write main three results of this dive.

1) Old serpentine-mud flow remains on the sedimented slope.

2) Two small mud volcanoes are fresh may be active.

3) Therefore the Turquoise SMT is old but reactive present.

1) Old serpentine-mud flow remains on the sedimented slope.

The Turquoise Seamount upper slope is formed from old and manganese coated serpentine-mud flow deposit, now appear on the sedimented gentle slope surface as a remnant ridge. Thickly manganese-crusted pelagic sediments shows rugged structure owing to the brittle deformation near the edge of a small ridge. Huge serpentinized peridotites irregularly scattered on the slope of a small ridge.

2) Two small mud volcanoes are fresh may be active.

Two tiny mud volcanoes, about 10 cm diameter and 10 cm height were encountered. Volcanoe have a small pit crater, about 3 cm diameter, on the summit of the edifice. The slope of the volcano was steep, say about 40 degree forming a slope failure in one volcano. White mud flow like mud was clearly seen on the slope. Therefore it seems likely that these mud volcanoes are active.

3) Therefore the Turquoise SMT is old but reactive present.

Above two observations puzzled us to understand the Turquoise Seamount. One evidence offer the seamount is old enough to be covered with thick manganese, that means several million years old. However we found an active small mud volcanoes and therefore they are quite young say present-day active. So we will conclude that the Turquoise Seamount was active in several million years ago and stopped their activity but recently the activity of seamount again started.

Principal Investigater: Kantaro FUJIOKA Dive#374

Preliminary Results of KAIREI 7000II Dive #374

Purpose and the progress of this dive

Main purpose of this dive

The main objectives of this dive are;

(1) To make a topographic and geological cross sectional overview of Turquoise Seamoumt at the southern slope.

(2) To take rock samples along the Kaikou 7000 Ⅱ ’s survey line,

(3) To sample sediments by MBARI corers at the summit area for the geochemical analyses.

Historical Review of Survey Area (References)

Prtricai Fryer and her coworlkers had many works on the topography, petrology and tectonics of the serpentine seamount in the Mariana Forearc. Her and her colleague’s work started from 1981 and published several tens papers concerning serpentine seamount. JAMSTEC research vessel visited here in 1992 to have two dives (#178 at Pacman Seamount, #179 at Conical Seamount and #180 at Coni-Pac triangle), R/V Kairei with Kaiko visited here in 2001 to have one dive at the South Chamorro Seamount and R/V Yokosuka with Shinkai 6500 to have 10 dives at S. Chamorro, Blue Monn, Celestial, Big Blue, Conical, Pacman seamounts and Coni-Pac Trianle.Fujioka et al., 2004, compiled the bathymetric study of these seamounts and tried to have a morphological differences. Yokose, 2006 tried to have morphological classification of serpentine seamount into conical and strike types based on the bathymetry.

Pre-dive Survey

SeaBeam swath mapping of the Turquoise Seamount was carried out by R/V Yokosuka in 2003 covering the whole seamount. Night survey of the foot area of the Turquoise Seamount was carried out after the dive #374 especially in the eastern side of the seamount.

Principal Investigater: Kantaro FUJIOKA Dive#374

Preliminary Results of KAIREI 7000II Dive #374

Dive Result 1

1) Topography

Turquoise Seamount (TQ SMT) lies at 1657’, 14711’E, forming a NNE-SSW trending small ridge at the summit.The summit of TQ is 3200 m just like CC (Conical) and SC (South Chamorro) but the bottom depth is rather deep compared with those of CC and SC. Whole edifice of the SM is like a pear spresding eastward where notable collapse and slope failure structure are seen.THis seamount shows the three stages of the growth process and development of the clear canyon and horse-shoe structure at the eastern part of the edifice. The story of evolution of the seamount is the first serpentine seamount was established then the second one constructed at rather western part and the eastern part was collapsed to form notable slope failures.

2) Geology

Sediments are divided into two mnajor unit; surface hemipelagic mud and underlying serpentine mud flow deposite inclusding a thick foraminiferal interval that indicate the sessation of the serpentine mud activity.The serpentine flow itself shows two types of mode of occurrences, massive serpentinized peridotite rich unit and metrix mud rich unit. These two different types continuously form a ridge like topographic high, but during this dive only remnant ridge was seen on the sediment surface.

Hard and thickly manganese coated (8 mm to 10 mm) hemipelagite or pelagites were seen everywhere along the dive root. Hard layer looks like a plate and the plate was deformed brittlely on a slope of the small serpentine mud flow ridge.

Slikenside structure was seen at the steep cliff of a small ridge showing a vertical displacement of the fault movement.

Principal Investigater: Kantaro FUJIOKA Dive#374

Preliminary Results of KAIKOU 7000II Dive #374

Dive Result 2

3) Biology

A fat fish swimming toward vehicle and collided with the blue handle of the MBARI corer.
Therr Galateas on the serpentinite block.
Trail of sea urchin.
Gorgonian and galssy sponge.

4) Others (Operation at sea floor)

Rake (Kumade) sampler is very useful for taking a lot of pebble size samples

Principal Investigater: Kantaro FUJIOKA Dive#374

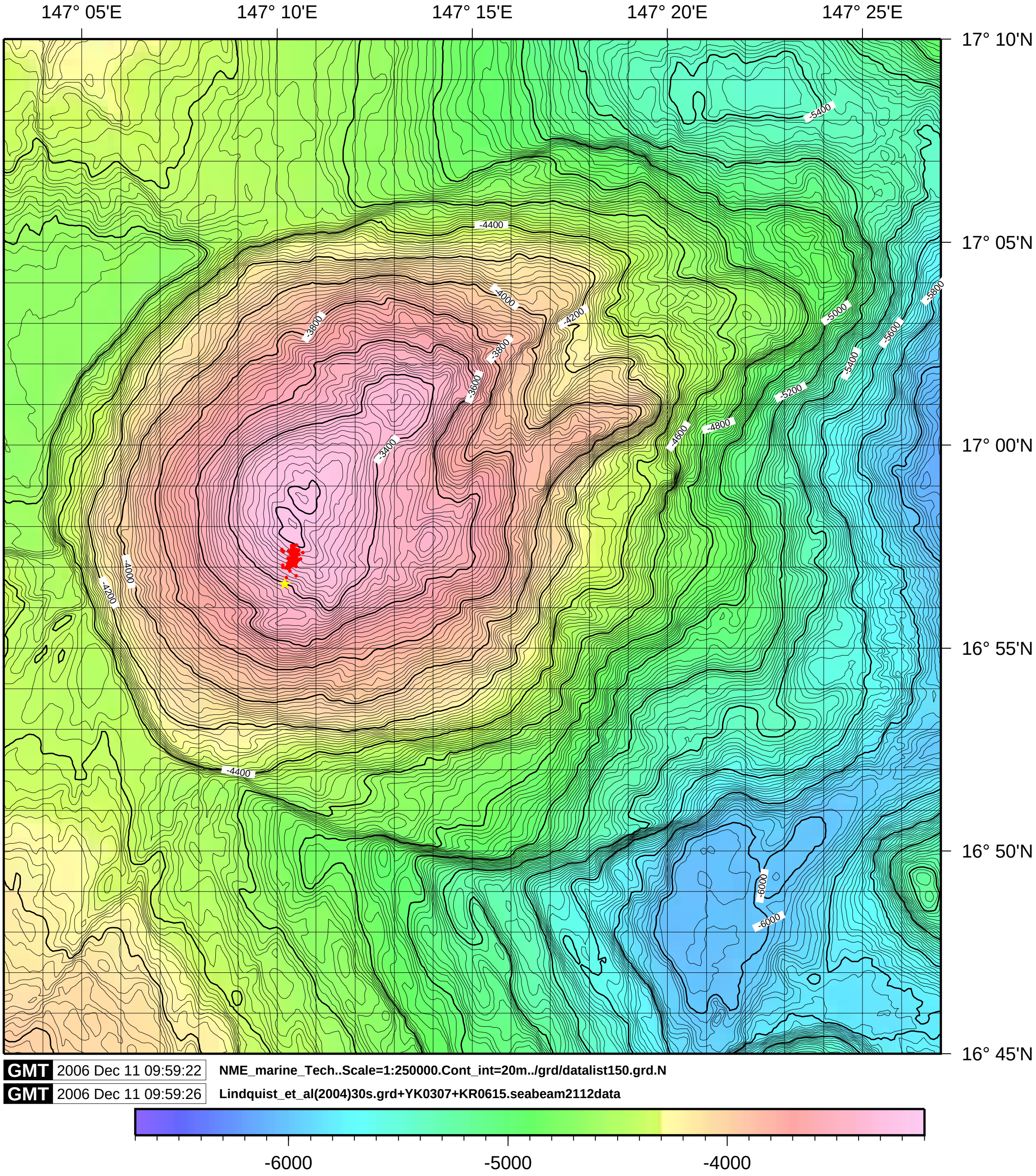
Preliminary Results of KAIREI 7000II Dive #374

5 minutes highlight of each dive results

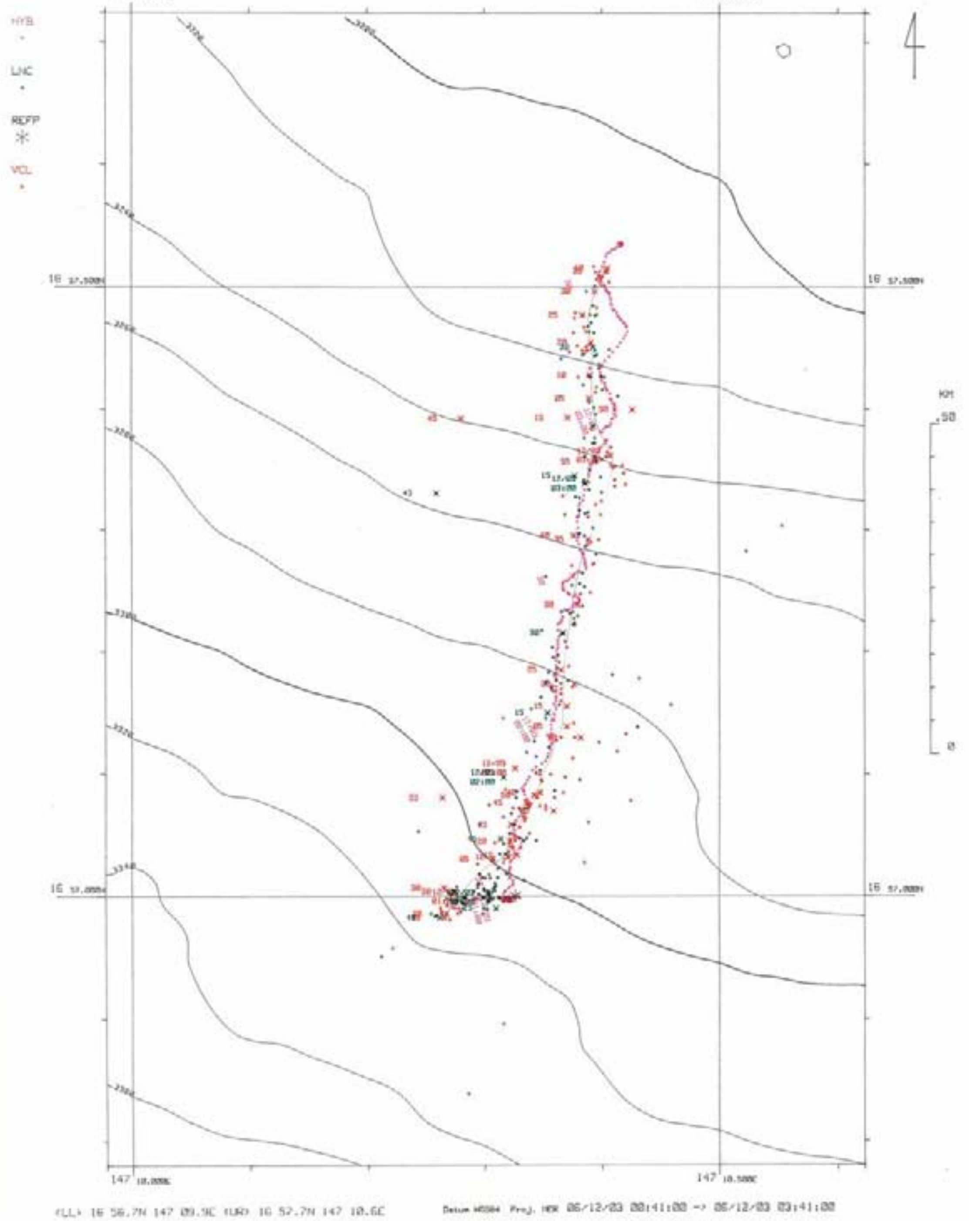
1)	10:43:27 ~ 10:43:43	Depth 3307 m	TV 3	Sampling of pebbles by Rake(Kumade) sampler.	0:00:16
2)	10:49:44 ~ 10:50:32	Depth 3305 m	TV 3	Remnant ridge made from old serpentine-mud flow now being coated with thin manganese oxide	0:00:48
3)	11:04:24 ~ 11:04:44	Depth 3290 m	TV 1	A fat fish colliding with MBARI corer handle and surprised then swim away.	0:00:20
4)	12:05:55 ~ 12:06:25	Depth 3286 m	TV 3	Amalgamation of huge peridotite block on a small remnant ridge	0:00:30
5)	12:16:10 ~ 12:16:30	Depth 3282 m	TV 3	Slikenside structure on the surface of a huge serpentinised peridotite showing a vertical displacement of a fault	0:00:20
6)	12:18:28 ~ 12:18:48	Depth 3281 m	TV 3	Three Galateas on the rock suggesting nearby cold seepage?	0:00:20
7)	12:28:00 ~ 12:28:30	Depth 3265 m	TV 3	Remnant of sledge of some vehicle, may be US deeo-tow visited here before	0:00:30
8)	12:49:50 ~ 12:50:08	Depth 3132 m	TV 3	Slab-like manganese oxide coated pelagic mudstone being caused by brittle deformation.	0:00:18
9)	12:57:35 ~ 12:58:04	Depth 3242 m	TV 3	Largest manipulater sampling of slab during this cruise by Sezoko	0:00:29
10)	13:12:07 ~ 13:12:56	Depth 3214 m	TV 3	Two tiny mud volcanoes now erupting white mud.	0:00:49
11)	13:40:28 ~ 13:40:48	Depth 3196 m	TV 3	Marker #374 was deployed for the future revisit by some tool	0:00:20
12)					0:00:00
13)					0:00:00
					Total Time: 05:00

Principal Investigater: Kantaro FUJIOKA Dive#374

KR06-15.7K.Dive.374.turquoise.SMT



KR06-15 KAIKO7000II Dive#374　Date 2006/12/03
MARIANA TRENCH　Scale (1/ 5000)



Dive Log of 7K Dive #374 Site Turquoise SMT 2006/12/03

Time (JST)	Dep. (m)	Alt. (m)	Head (Deg)	Description	Remarks	Latitude/ Longitude	
				Landing on the water			
				driving for the sea floor			
	1000			launcher depth: 1000m, driving for the sea floor			
	2000			launcher depth: 2000m, driving for the sea floor			
	2500			launcher depth: 2500m, driving for the sea floor			
	3000			launcher depth: 3000m, driving for the sea floor			
				arrive at the leaving point			
				leave the vehicle			
10:36	3305	8	352	arrive to the sea bottom		16º-56.9863'N/ 147º-10.2628'E	
10:42	3306	0	28	(st.1) sampling by the rake and putting in the box. Mud with rounded gravels (<3cm)	No.1 (rake1)	16º-56.9863'N/ 147º-10.2628'E	
10:48	3305	2	36	serpentinite talus. <20cm sub angular to sub rounded pebbles			
10:50	3305	0	39	(st.2) sampling by the arm. Putting in the (F:#374-02R-01) (17cm sub angular)	No.2 (rock1)	16º-57.0014'N/ 147º-10.2774'E	
10:52	3305	0	39	(st.2) sampling by the arm. Putting in the (F:#374-02R-02) (7cm angular)	No.3 (rock2)		
10:53	3305	0	39	(st.2) sampling by the arm. Putting in the (F:#374-02R-03) (11cm angular)	No.4 (rock3)		
10:55	3305	0	39	(st.2) sampling by the arm. Putting in the (F:#374-02R-04) (15cm sub rounded)	No.5 (rock4)		
10:57	3305	0	39	(st.2) sampling by the arm. Putting in the (F:#374-02R-05) (5cm angular)	No.6 (rock5)		
10:59	3302	2	40	muddy bottom			
11:00	3296	5	42	mud with <40cm sub angular pebbles on the bottom			
11:04	3290	0	20	a big fish and crushed			
11:07	3286	2	18	muddy bottom with many holes			
11:08	3285	0	17	(st.3) talus, sampling and putting on the F (#374-03R-01) (12cm angular)	No.7 (rock6)	16º-57.0340'N/ 147º-10.3249'E	
11:10	3285	0	17	(st.3) talus, sampling and putting on the F (#374-03R-02) (8cm sub angular)	No.8 (rock7)		
11:12	3285	0	17	(st.3) talus, sampling and putting on the F (#374-03R-03) (6cm sub angular) and Mn-coating	No.9 (rock8)		
11:14	3285	0	17	(st3) talus, sampling and putting on the F (#374-03R-04) (18cm platy)	No.10 (rock9)		
11:18	3285	0	17	(st.3) talus, sampling and putting on the E (#374-03R-05) (7cm platy)	No.11 (rock10)		
11:20	3285	0	17	(st.3) talus, sampling by the rake and putting in the box. Mud with many rounded pebbles (<5cm)	No.12 (rake2)		
11:21	3285	0	17	(st.3) talus, sampling by the rake and putting in the box. Mud with many rounded pebbles (<5cm: the same above)	No.13 (rake3)		
11:25	3281	3	20	mud with <3cm pebbles. There are many holes and living trace. Marine snow is little.			
11:35	3276	0	45	(st.4) talus, angular to sub angular and partly platy <60 cm size pebbles. getting by the arm and putting on the (E:#374-04R-01) (>20cm angular)	No.14 (rock11)	16º-57.0730'N/ 147º-10.3371'E	
11:40	3276	0	45	(st.4) sample putting on the E (#374-04R-02)	No.15 (rock12)		
11:44	3276	0	42	(st.4) talus. getting by the arm and putting on the (E:#374-04R-03) (13cm trapezoid, platy and angular)	No.16 (rock13)		
11:46	3276	0	42	(st.4) talus. getting by the arm and putting on the (D:#374-04R-04) (5cm sub rounded)	No.17 (rock14)		
11:47	3276	0	42	(st.4) talus. getting by the arm and putting on the (E:#374-04R-05) (10cm sub angular)	No.18 (rock15)		
11:48	3274	2	20	mud with <3cm pebbles. There are many holes and living trace.			
11:51	3276	0	89	(st.5) talus.sampling by the arm and put in E (#374-05R-01) (7 cm)	No.19 (rock16)		
11:56	3276	0	89	(st.5) talus.sampling by the arm and put in E (#374-05R-02) (7 cm)	No.20 (rock17)		
11:57	3276	0	89	(st.5) talus.sampling by the arm and put in E (#374-05R-03) (17 cm rounded)	No.21 (rock18)		
12:00	3276	0	89	(st.5) talus.sampling by the arm and put in E (#374-05R-04: lost) (7 cm muddy)	No.22 (rock19)		
12:06	3286	0	341	(st.6) outcrop,Amalgamation,Mn coating			
12:10	3286	0	341	(st.6) sampling by the am and put in E (#374-06R-01) (17cm sub rounded and half Mn-coated)	No.23 (rock20)		

Dive Log of 7K Dive #374 Site Turquoise SMT 2006/12/03

Time (JST)	Dep. (m)	Alt. (m)	Head (Deg)	Description	Remarks	Latitude/ Longitude	
12:13	3286	0	341	(st.6) sampling by the am and put in D (#374-06R-02) (12cm angular and 1/3 Mn-coated)	No.24 (rock21)		
12:15	3284	0	356	mud with <3cm pebbles. There are many holes and living trace.			
12:16	3281	4	354	three Koshoori shrimps. The end of flow, and platy Mn-coated rocks.			
12:18	3281	4	354	(st.7) sampling by the am and put in D (#374-07R-01) (12cm angular and one aspects Mn-coated)	No.25 (rock22)		
12:20	3281	4	354	(st.7) sampling by the am and put in D (#374-07R-02) (15cm sub angular and one piece is Mn-coated)	No.26 (rock23)		
12:21	3281	4	354	(st.7) sampling by the am and put in D (#374-07R-03) (7cm sub angular and one piece is Mn-coated)	No.27 (rock24)		
12:22	3281	0	354	(st.7) sampling by the am and put in D (#374-07R-04) (7cm sub angular)	No.28 (rock25)		
12:28	3265	0	3	trace of USA vehicle landing			
12:30	3263	0	13	trace of USA vehicle landing			
12:31	3262	3	10	shrimp is crushed			
12:32	3262	2	10	mud with <3cm pebbles and many living trace.			
12:33	3256	0	359	shrimp walk			
12:42	3250	0	24	living trace			
12:49	3241	3	356	(st.8) strange sand topography			
12:51	3242	0	44	(st.8) try to sampling ,but failed because it was hard solid			
12:56	3241	2	83	(st.8) sample by rake, and put in box	No.29 (rake4)		
12:58	3241	2	83	(st.8) sample big gravel (>30cm platy and thick Mn coating) with starfish by arm, and put in D (#374-08R-01).	No.30 (rock26)		
13:03	3232	4	3	red shrimp			
13:06	3224	1	5	trace of USA vehicle and living trace			
13:11	3214	12	2	(st.9) small conical mound and touch it by arm			
13:16	3214	12	2	(st.9) sample the mound by MBARI(30cm blue, 4/5 full)	No.31 (MBARI blue)		
13:24	3200	3	18	(st.10) sample a gravel by arm and put in A (#374-10R-01) (16cm rounded)	No.32 (rock27)		
13:27	3197	2	16	sponge and starfish			
13:29	3196	1	20	many living trace			
13:32	3195	0	35	(st.11) getting the sample by the arm and putting on A (#374-11R-01) (#374-10R-01) (platy and 13cm)	No.33 (rock28)		
13:35	3195	0	35	(st.11) getting the sample by the arm and putting on C (#374-11R-02) (15cm angular)	No.34 (rock29)		
13:39	3196	0	66	(st.11) getting the sample by MBARI (30cm black, full filled)	No.35 (MBARI) black		
13:40	3196	0	66	set a marker "KAIKO7000II #374" on the floor!!			
13:41	3196	0	4	leave the bottom			
				surfacing			

Preliminary Results of KAIREI 7000II Dive #375

Dive No.	375	**Date**	2006/12/8	
	Name	**Affiliation**		
English	Koshi YAMAMOTO	Nagoya University		
Japanese	山本　鋼志	**Address**		
Speciality	Geochemistry	Furo, Chikusa, Nagoya, Aichi 464-8602		
Theme	Geography, Geology, Petrology and Interstitial Water Chemistry of North Chamorro Seamount, Mariana Forearc			
Area	Mariana Trench			
Site	North Chamorro Seamount, Marinana Forearc			
	Latitude	**Longitude**	**Time**	**Depth**
Landing	13º-55.4146'N	146º-14.5460'E	12:25	3475 m
Leaving	13º-55.8461’N	146º-14.3420'E	14:44	3448 m
Cruising Distance	1000 m	**Deepest Point**	3475 m	
Dive Summary	The Kaiko 7000II vehicle landed at the south edge of summit plain of the North Chamorro Seamount at 12:12 pm on December 8, 2006, and moved just north along a valley tending NS in order to collect rock and sediment samples and to find chimnies. The surface of the seamount was entirely covered with muddy sand containing abundant foraminiferal remains with scarce lithic fragment. Ripple mark was rextremely developed almost everywhere. We encountered surficial mudflow at two points (stations 2 and 3) and three MBARI cores were taken in the center of the flows. However, a part of sediments in the sampling tube flowed out from the mouth of the tube. We changed the cource of vehicle from north to NNW (330 degree) at 12:48. On the way to the southern summit, we found lithic float fragment and blocks (stations 5-8), which show more frequent occurrence toward the summit. These roks have been supplied from the vicinity of southern summit by bed flows. We collected 3 MBARI samples, 14 rock samples, and lithid fragme			
Apparatus	Box, MBARI 30cm x 2, MBARI 50cm x 2, Rake			
Visual Records	TV2, TV2, TV3, Still 82			
Samples	Serpentinite 10, Sepentinized Pridotite 2, Pumice 1, Mudstone 1			
Key Words	North Chamorro Seamount, sepentine flow, float serpentine blocks			

Principal Investigater: Koshi YAMAMOTO Dive#375

Preliminary Results of KAIREI 7000II Dive #375

Summary of Results (For press)

Please write main three results of this dive.

1) This seamount is composed mainly of serpentine.

2) This seamount may have entrained metamorphic blocks during upwelling of serpentinite.

3)

1)This seamount is composed mainly of serpentine.

Though many cores had collected at South Chamorro Seamount by Fryer et al. (1999), there is no research at the North Chamorro Seamount. During the dive #375, we could not investigate interior structure of the seamount, because the vehicle moved around the summit plain of the seamount. Fourteen floating rocks were collected at the summit plain by the manipulator of Kaiko 7000II. Most are surpentinite, suggesting that North Chamorro seamaount is also composed mainly of serpentine like other forearc seamounts.

2) This seamount may have entrained metamorphic blocks during upwelling of serpentinite.

During #375 dive, we collected 14 rock samples, and most of them are serpentinites. Among them, #375-07R-01, a sheared sepentinite, contain basaltic fragments. Maekawa et al. (1993) reported the presence of clasts subjected to the blueschist facies metamorphism in Conical Seamount. Such metamorphic clasts are also reported from South Chamorro Seamount (Fryer et al., 1999). It seems that metamorphic clasts are found in seamounts far from the trench axis. In this sense, North Chamorro Seamount may yield motamorphic clasts like Conical Seamount.

3)

Principal Investigater: Koshi YAMAMOTO Dive#375

Preliminary Results of KAIREI 7000II Dive #375

Purpose and the progress of this dive

Main purpose of this dive

Main purposes of this dive #375 are 1) to collect lithic blocks and 2) to find chimnies, at the summit plain of North Camorro Seamount. The formaer dives of KR06-15 cruise, #369-374, aimed mainly to investigate cliffs of seamounts in order to clarify the interior structure of seamounts. In this dive, we intended first to recover metamorphic clasts entrained in the serpentine seamounts. Subordinately, calcite chimnies may be found along the valley tending NS of the summit plain.

Historical Review of Survey Area (References)

Though many cores had collected at South Chamorro Seamount by R/V Thomas G. Thompson cruise (Fryer et al., 1999), there is no report about the North Chamorro Seamount up to date. During YK03-07 cruise, morphological survey using seabeam system had performed and the map of North Chamorro Seamount wes reported in the cruise report.

Pre-dive Survey

Bathymetric survey was carried out by YK03-07 cruise.

Principal Investigater: Koshi YAMAMOTO Dive#375

Preliminary Results of KAIREI 7000II Dive #375

Dive Result 1

1) Topography

Mariana forearc seamounts are grouped into two types by the topographic shape; one is conical in shape represented by the Conical, Celestial and South Chamorro Seamounts and the other have complicated shape like Big Blue and Tourquoise Souamounts. The North Chamorro Seamount can be grouped into the former conical-type seamount, but has a broader summit plain compared to Conical and South Chamorro Seamounts. In the research dive #375, the vehicle landed on the southern edge of the summit plain, and searched for chimnies and floating rocks. The summit plain is covered by muddy sand containing large amounts of foraminiferal remains and show well developed ripple mark. In two places, we found serpentine flows and collected MBARI samples. The MBARI samples indicated that the flow of serpentine mud is limited to the surficial layer about few cm.

2) Geology

All rocks on the summit plain and sediments covering the seamount are mostly composed of serpentine. However, we could not clarify the geology of North Chamorro Seamount, because the vehicle only searched the summit plain during #375.

Principal Investigater: Koshi YAMAMOTO Dive#375

Preliminary Results of KAIKOU 7000II Dive #375

Dive Result 2

3) Biology

Some kinds of fishes and shrinps were observed during the dive. Just after start of the dive#375 (12:48), we saw a deep-sea fish with smooth face and big mouth.

4) Others (Operation at sea floor)

Size of the sample basket is not enough for geological survey.

Principal Investigater: Koshi YAMAMOTO Dive#375

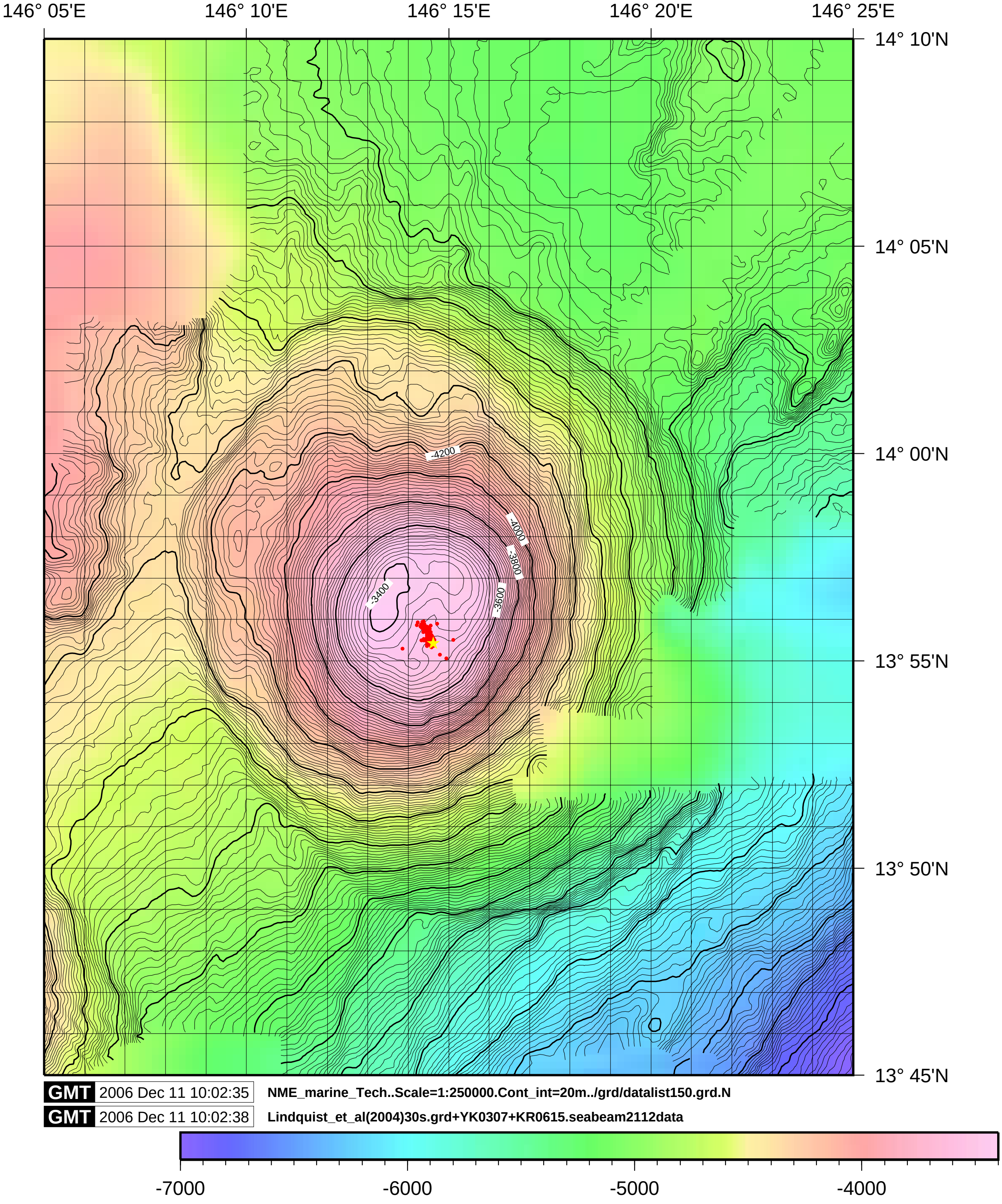
Preliminary Results of KAIREI 7000II Dive #375

5 minutes highlight of each dive results

1)	12:47:56 ~ 12:48:30 Depth 3479 m TV1 Sediments with ripple mark and surficial mudflow	0:00:34
2)	13:02:17~ 13:03:04 Depth 3476 m TV 3 Sediments with ripple mark and surficial mudflow	0:00:47
3)	13: 08:44 ~ 13:09:26 Depth 3475 m TV3 MBARI sampling in the center of surficial mudflow	0:00:42
4)	13:12:00 ~ 13:12:40 Depth 3374 m TV3 A carcass of an unknown deep-sea fish	0:00:40
5)	13:20:40 ~ 13:21:05 Depth 3470 m TV3 A disposed can on the seamount	0:00:25
6)	14:23:14 ~ 14:23:41 Depth 3452 m TV3 Float fragments of serpentinite on the muddy sandstone sediment	0:00:27
7)	14:25:31 ~ 14:26:13 Depth 3452 m TV3 Sampling of a float serpentinite (#375-07R-01).	0:00:42
8)	14:36:20 ~ 14:37:00 Depth 3451 m TV3 Marker #375 was deployed for the future revisit by some tool	0:00:40
9)		0:00:00
10)		0:00:00
11)		0:00:00
12)		0:00:00
13)		0:00:00
		Total Time: 04:57

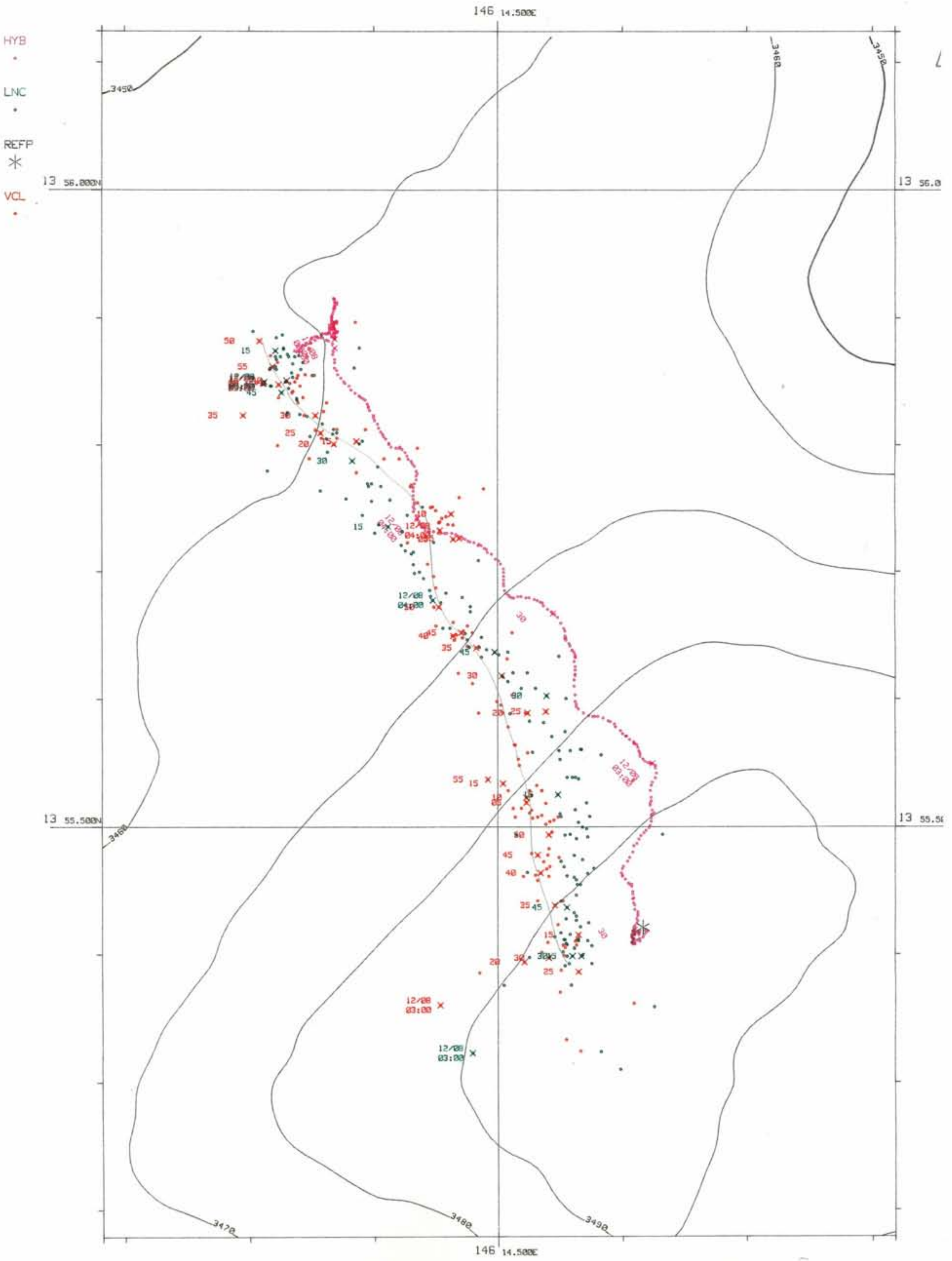
Principal Investigater: Koshi YAMAMOTO Dive#375

KR06-15.7K.Dive.375.NorthChamorro.SMT



KR06-15 KAIKO7000II Dive#375 Date 2006/12/08

MARIANA TRENCH Scale (1/ 5000)



Time (JST)	Dep. (m)	Alt. (m)	Head (Deg)	Description	Remarks	Latitude/ Longitude	
				driving for the sea floor			
11:26	1000			launcher depth: 1000 m, driving for the sea floor			
11:43	2000			launcher depth: 2000 m, driving for the sea floor			
11:57	3000			launcher depth: 3000 m, driving for the sea floor			
12:12	3354	130	65	leave the vehicle		13º-55.4128'N/ 146º-14.5719'E	X: -13.3 Y: -86.7
12:24	3475	11	352	visible on the bottom, current ripple, the trench direction is NS trend.			
12:25	3484	0	19	arrive at the bottom, ripple mark is covered by new serpentine mud flow. (st. 1) get the surpentine flow (?) used by MBARI 30 cm (blue) The 1/1 corer is filled	No. 1 (core 1)	13º-55.4146'N/ 146º-14.5460'E	X: -10.0 Y: -133.3
12:36	3484	1	10	pellet			
12:42	3480	0	27	(st. 2) try to get the black pebbles with mud used by rake put in the box (B). Try three times.	No.2 (rake 1)	13º-55.4797'N/ 146º-14.5441'E	X: 110.0 Y: -136.7
12:48	3478	1	352	a fish			
12:56	3477	1	0	pellet			
13:00	3476	1	334	course change to 330 degree			
13:02	3476	0	334	ripple covered by surpentine mud flow			
13:05	3475	0	21	(st. 3) get the surpentine flow used by MBARI 30 cm (black). The 1/1 corer filled. Uppermost section is composed of surpentine mud flow ?	No. 3 (core 2)	13º-55.5274'N/ 146º-14.5278'E	X: 198.0 Y: -166.0
13:10	3475	0	349	(st. 3) get the surpentine flow used by MBARI 50 cm (red). The 1/4 corer filled.	No. 4 (core 3)		
13:12	3474	2	325	dead fish?			
13:21	3470	1	319	can (oil)			
13:28	3467	0	334	arrive at the bottom, (st. 4) get the seafloor sediments with black pebbles by using the rake, put in the box (B)	No. 5 (rake)	13º-55.6022'N/ 146º-14.5123'E	X: 336.0 Y: -194.0
13:29	3467	1	333	leave the bottom			
13:41	3462	0	314	arrive at the bottom, (st. 5) get the rock sample (pumice) by the arm, put in the box (F:#375-05R-01)	No. 6 (rock1)	13º-55.6597'N/ 146º-14.4823'E	X: 442.0 Y: -248.0
13:47	3462	1	300	leave the bottom			
13:57	3458	0	353	shell			
14:00	3458	0	331	a number of rocks on the sea floor			
14:02	3458	0	325	arrive at the bottom, (st. 6) get the rock sample by the arm, put in the box (F:#375-06R-01)	No. 7 (rock2)	13º-55.7387'N/ 146º-14.4564'E	X: 587.7 Y: -294.6
14:03	3458	0	325	arrive at the bottom, (st. 6) get the rock sample by the arm, put in the box (F:#375-06R-02)	No. 8 (rock3)		
14:04	3458	0	325	arrive at the bottom, (st. 6) get the rock sample by the arm, put in the box (F:#375-06R-03)	No. 9 (rock4)		
14:05	3457	0	327	arrive at the bottom, (st. 6) get the serpentine mud? by the arm, put in the box (E:#375-06R-04)	No. 10 (rock5)		
14:08	3457	0	327	(st. 6) get the rock (boulder size) by the arm, put in the box (F:#375-06R-05)	No. 11 (rock6)		
14:10	3457	0	327	(st. 6) get the rock sample by the arm, put in the box (F:#375-06R-06)	No. 12 (rock7)		
14:10	3456	2	338	leave the bottom			
14:15	3455	1	333	a number of black pebbles on the sea floor			
14:23	3451	0	295	arrive at the bottom			
14:24	3452	0	300	(st. 7) get the rock sample by the arm, put in the box (D:#375-07R-01)	No. 13 (rock8)	13º-55.8092'N/ 146º-14.3542'E	X: 717.7 Y: -478.6
14:26	3452	0	300	(st. 7) get the rock sample by the arm, put in the box (E:#375-07R-02)	No. 14 (rock9)		
14:27	3452	0	300	(st. 7) get the rock sample by the arm, put in the box (E:#375-07R-03)	No. 15 (rock10)		
14:28	3452	0	298	(st. 7) get the rock sample by the arm, put in the box (E:#375-07R-04)	No. 16 (rock11)		
14:28	3451	2	323	leave the bottom			
14:33	3451	0	327	arrive at the bottom			
14:34	3451	0	327	(st. 8) get the rock sample by the arm, put in the box (A:#375-08R-01)	No. 17 (rock12)	13º-55.8461'N/ 146º-14.3420'E	X: 785.7 Y: -500.6
14:35	3451	0	327	(st. 8) get the rock sample by the arm, put in the box (A:#375-08R-02)	No. 18 (rock13)		
14:36	3451	0	327	(st. 8) get the rock sample by the arm, put in the box (D:#375-08R-03)	No. 19 (rock14)		
14:36	3451	0	327	set a flag (KAIKO 7000II)			
14:38	3451	0	327	(st. 8) get the sea floor sediments by using the rake, put in the box (B)	No. 20 (rake)		
14:44	3448	3	172	leave the bottom			

V. Preliminary results

Bathymetry and morphology of Mariana forearc serpentine seamount - A perspective for the solution of a puzzle of formation, development and recycling of Mariana Forearc Serpentine Seamount as a key for the understanding onland high pressure metamorphic terrenes and mélange formation-

Written by K. Fujioka, H. Yokose, Y. Fujimoto, Sato, M. Takaesu, and H. Maekawa

Introduction

During the cruise GUESS (Geological Undersea Expedition of the Serpentine Seamount) cruise from 20º to 13ºN we had surveyed with bathymetry and geophysical equipment along the Mariana forearc and found several Serpentine Seamount (SS) other than those during YK03-11 cruise. They are three big SS distributed south in-between the Pacman and Big Blue SMT. There are several more newly found SS east of Big Blue Seamount (BB SMT) and Celestial SMT.

SEA BEAM mapping was carried out almost 90 % of the area so we summarize the morphological overview of SS along the Mariana forearc.

General arrangement of the Mariana arc-trench system

Mariana arc-trench system, MATS, is one of the typical oceanic arc and oceanic plate system which extends from the Izu-Bonin arc-trench system to the Challenger deep, almost 2500 km long, forming an arcuate morphology toward the Pacific Ocean. The MATS consists of remnant arc, backarc basin, volcanic front, old arc forearc seamount chain (serpentine mud volcano) and trench from west to east. Mariana Trough occupies the central part of the MATS between remnant arc and volcanic front, spreading since 6 Ma to the present to form an almost N-S trending broad ridge and trough structure. Volcanic front starts from the end of the Izu-Bonin arc at around 25N, forming an active volcanic island such as Iwojima Is., Nikkou SMT. Sanpuku SMT., Kasuga SMT., Daikoku SMT., Farallon de Pajaros, Maug Is., Asuncion Is., Agrigan, Pagan, Alamagan, Guguan, Zealandia Bank, Sarigan and Anatahan and submarine volcanoes that have no mane making a line with a regular interval. Old arc consists of big islands such as Rota, Saipan and Guam from north to south, however the lineament is truncated at around 18ºN to 19.5ºN where a huge forearc basin stretches toward east. Forearc seamount chain is a serpentine mud-hosted seamount, which will describe below forming another chain like a volcanic front having a regular interval, shape, and size of the seamount.

Recently the MATS were divided morphologically into three or four segments (Stern and Smoot, 1999; Fujioka et al., 2002; Seama et al., 2003). The southern Mariana is a transform fault that extends form Guam to Palau laterally since about 6 Ma (Fujioka, et al., 2002). However Fryer et al (2003) insisted the southern Mariana is not a transform fault but a broken slab forms a roll back movement. Seama et al (2003) and Yamazaki et al (2002) classified the Mariana Trough into four morphological segments and evolutional stages, northern at around 22 to 20 degree, north central, central and southern respectively. As for the forearc system the four segments seem to be reasonable but it will be more complicated if we take into account the collision of the huge seamount chain at the trench axis. Daton seamount chain and other three chains or volcanoes are colliding with the trench where the forearc morphology is highly disturbed to form extremely shallow, anomalous bathymetry.

I intend here to divide the MATS into four segments northernmost, north, central and south, respectively. The northernmost lies from 25ºN to 23ºN where no rifting occurs with single volcanic chain. The north segment is from 23º to 20º where initial spreading of the Mariana Trough and a few serpentine seamount at the forearc. The central segment is a dominant part of the MATS starts from 20º to 17º. Here backarc spreading of the Mariana Trough, no Outer arc, many serpentine seamount at the forearc and many collision at the trench axis. The final south segment starts from 17º to 13ºN and is truncated at the southern end by transform fault.

At the forearc region of the MATS, serpentine mud volcanoes seem to have a regular interval, shape, and size but have an exception. The distance from one seamount or group of seamounts, to another is about 20 to 30 miles but the distance between North Chamorro to Blue Moon is more than 120 miles and between Big Blue to Turquoise is more than 60 miles. In between these intervals it seems to have a seamount-like structure but it is uncertain at this point.

Our bathymetric survey by SEA BEAM 2112 with R/V Yokosuka covers more than 2500-mile swath mapping and making a small boxes at Chamorro, Blue Moon, Celestial, Big Blue, Coni-Pac Triangle system.

We intend to describe here the morphologic features of these seamounts and to classify them into two genetic types based on their features. We use the names of seamount that were given by Fryer et al (1999) for the major serpentine seamounts. However for the convenience of the description, the name of the seamounts will be abbreviated shortly as follows; SC: South Chamorro, NC: North Chamorro, BM: Blue Moon, PC: Peacock, CT: Celestial, TQ: Turquoise, BB: Big Blue, PM: Pacman, CC: Conical, respectively. Table 1 shows the various features of the seamounts.

General distribution of serpentine seamount

As has already written in the previous study of SS, we already mapped several SS by SEA BEAM apparatus and in this cruise we found several new data on the unknown SS. These data allow us to classify the SS into three morphological types; Conical, Strike and Line respectively.

The Conical type (C-type) SS is Conical SMT that resemble with Mt. Fuji having gentle slope of each side. The Strike type (S-type) is Celestial that resemble with the strike of the Japanese temple. Line type is the eastern wall of the Big Blue SMT that is line itself. These three types represent the genetic feature of the SS.

On the other hand two different types of SS in respect to the distribution. Singular and multiple. S-type is an isolated SS like Conical and M-type is Big Blue consisting of many peaks of summit within one SS.

Along arc variation of SS shows a regular spacing of the existence about xx to yy miles interval that suggest the Rayligh-Taylor instability like volcanoes along the volcanic front. The spacing is smaller than that of volcanic front means the different viscosity of the serpentinized peridotite and serpentine-mud mixture compared with ordinary volcanic rocks.

Across arc variation is that the Conical SMT about 90 km and Nagaimo is about 15 km from the trench axis. The belt of serpentine seamount is 75 km zone parallel to the trench axis.

The distribution of SS seems three parallel lines similar distance from the trench axis. Most trench ward SS is Nagaimo and Unknown, about 15-20 km middle line consists most of the SS, about 50-70 km and most landward SS is Conical and South Chamorro, about 90 km.

Morphologic Description of each SMT

South Chamorro Seamount (SC SMT)

The SC has a typical conical shape with summit at 13º46’N, 146º01’E.and the water depth of the summit is 2950 m by our SEABEAM 2112 system. The shape of the summit of SC is a small cone like structure but if we look at the shape carefully the NW-SE length is about 4 km longer than that of NE-SW. If we assume the body is an ideal cone we can calculate the volume is something to be 2660 km^3 above the basement of the seamount. If the serpentinization of the SC will be 90 % of original peridotite water volume needed to make serpentine minerals is estimated to be 10^{15} kg. South Chamorro Seamount formation seems to be young but takes about 1 m.y. then we can get a supply rate of H2O from the slab to be 10^6 t/y. We have an extrapolation concern the water from the sediments of the subducted slab, however it seems to be the waste of time.

We had four dives to the SC #777 to #780 during this cruise but actually we had four more dives were conducted by Shinkai 6500, “280, 281, 351 and by Kaiko #165, from1996 to 2000. OODP Leg 195 cruise drilled several holes around the summit in March 2001. The Hole 1200 A to F distributed within a narrow area of the north slope at the summit. Hole 1200C has an A-CORK experiment on the seafloor. The most important results of the dives and drilling are that high alkalic and high pH pore fluid makes a seep to sustain chemosynthetic community. We tried to map the distribution of clam communities, markers, holes, and serpentine mud flows and sample cold seep fluid by WHATs, Niskin and pump sampler, sediments by push and MBARI corer, rocks and bivalves by manipulator.

The activity of the cold seep seems to be weak compared with that at the time of #165 dive by Kaiko, 2000 based on the ratio of living clams at the same site. We observed vary curious sediments thinly covering the previously living clam community that is now almost extinct by the newly rapid supply of the artificially caused flood of drilled sediments. We call this a “drill induced extinction”.

As for the decision of the drilling site especially precious communities are living we have to carefully chose the site taking into account everything specially micro-topography and current system there, etc.

North Chamorro Seamount (NC SMT)

The NC is also conical seamount whose shallowest peak is located at 13º56’N, 146º14’E and the depth is 3400 m. The size of the body of NS is larger than SC. The NC has an elongated shape at NW-SE direction and the slope of the SE slope is steeper than that of at NW. Slope failure and lobe structures are seen on the NW slope but on the SE slope many topographic inflection points are recognized but few slope failure.

Blue Moon Seamount (BM SMT)

The BM is a rather deformed seamount whose shallowest peak lies at 15º44’N, 147º13’E and the depth is 3600 m. The eastern slope of the BM is highly deformed by the slope failure and also at the southwestern foot is deformed by the same process. The density of contour line from the shallower than 4200 m is much denser than that of the lower slope but the eastern slope shows rather gentle slope even at the shallower part.

Dive #781 was conducted at the summit area where a notable NE-SW trending fault cutting the body. The result of the dive is negative for the activity of cold seep and serpentine mud flow instead we got many dark brown semi-consolidated pelagic sediments and manganese crusts. Deformation of manganese crusts will remind us to have an active fault movement along this fault. However, R/V Thomas Thompson obtained serpentine mud sediments from somewhere of the BM therefore it is estimated that the activity of serpentine mud volcanism and cold seep did exist but already ceased long before.

Bathymetric interest of the BM is two holds; the nearest position from the trench axis, 55.6 km and deepest water depth of the surrounding forearc area, more than 5000 m.

Peacock Seamount (PC SMT)

The location of PC that has three peaks is 16º03’N, 147º07’E and the water depth is 3650 m. The PC has egg-like shape as a whole but in the northeastern foot there are many canyons and ridge structures are seen in the bathymetric map. Bathymetric interest of the PC is, also like BM, the deepest water depth of the surrounding forearc area, more than 5000 m.

Celestial Seamount (CT SMT)

The CT is NNE to SSW elongated ellipsoidal shape with summit depth being 1900 m and is located at 16º32’N, 147º13’E. The northern summit area collapses largely to form caldera-like structure and debris of the failure makes a ridge structure along the northern slope. The western foot of the CT has a small depression, small knoll and canyons by unknown process makes the whole edifice to be ugly compared with the other conical seamounts. The topographic contour line is dense from the shallower part than 2600 m that indicates two stages evolution of the CT.

Dive #782 was conducted at the northern slope where a huge slope failure occurred. We landed at the thick sediment coved valley and climbed up at the summit of the CT. A notable slickenside structure was seen near the summit that shows the downward movements of mass waiting of serpentine mud flow deposits. Along the summit ridge we got several pieces of calcareous cemented hard rocks and chert. The result of the dive indicated that the activity of serpentine mud volcanism and related cold seepage has ceased before.

Turquoise Seamount (TQ SMT)

The location of the summit of the Turquoise Seamount is 16º57’N, 147º11’E, forming a NNE-SSW trending small ridge at the summit. The summit of TQ is 3200 m just like CC and SC but the bottom depth is rather deep compared those of CC and SC. Whole edifice of the seamount is like a pear spreading eastward where a notable collapse and slope failure structure are seen.

This seamount shows the three stages of the growth process and development of the clear canyon and horseshoe structure at the eastern part of the edifice. The story of evolution of the seamount is the first serpentine seamount was established then the second one constructed at rather western part and the eastern part was collapsed to form notable slope failures.

Big Blue Seamount (BB SMT)

The Big Blue seamount is a complex one consisting of many small peaks of knolls surrounding the main seamount. The location of the summit is the shallowest of all the Mariana Forearc serpentine seamount as shallow as 1232 m. The shape of BB is quite irregular with notable canyons at NE and NW slopes. At least five peaks are recognized and several ranges deform the seamount shape. It seems likely to say that the geographic position of the BB is just collision part between Daton seamount chain and Mariana trench. Complex morphology may reflect such a geological situation.

Dive #783 by Shinkai 6500 was conducted in order to have a reconnaissance of BB. The dive started at the southern slope on the slope break and found an old serpentine mud flow deposits forming a small ridge which was covered with thick pelagic and/or calcareous sand and ripple marks were observed on the sediment surface. At the foot of the inflection point thick sediments of talus debris forming a talus fan. As we climbing up the southern slope many thin layers of serpentine flows are seen to form a BB body. Near the summit inclination of slope changes more gently and sediment cover is less thick compared with topographic low on the slope. Carbonate encrusted serpentine flows form a summit edifice. Two notable whitish ridges were recognized where shell fragments are scattered on the surface. Rugged surface of the summit consists of serpentine mud flow encrusted by carbonate. Many tiny shell fragments were encountered during the dive. Activity of the cold seep at the BB may cease just before our dive because that we obtained bivalve fragment from the serpentine mud and thin cover of pelagic sediments at the summit.

Pacman Seamount (PC SMT)

The PC is a queer seamount as for its shape because it happened a huge slope failure at the eastern half of the seamount body at some time. SEABEAM bathymetric map shows a notable horse-shoe structure 10 mile long and 5 mile wide forming a depression at the foot of the eastern slope and a large swell east off the seamount. The location of the peak is 19º16’N, 146º55’E and the water depth is 2780 m by SEABEAM 2112 bathymetry. EW trending two arms are notable therefore representing U-shape with its mouth open to the east. Our bathymetry result indicates that a slight change of the contour density at the north and south arms which have several steps on their ranges.

Alvin and Shinkai 6500 had dive to PC in 1987,1993 respectively and found a baby carbonate chimney make a line with NS direction. Especially dive #178 (Patty Fryer was an observer) showed magnificent small chimneys with pale green stuff on their surface. Review observation of videos during #178 dive I found several small pockmark near the site of leave bottom on the flat sediment surface covered by pelagic mud. Many trails of sea urchin and sea cucumber and small hole may be caused by the gas bubbling were clearly seen in the video. #784 dive was conducted to confirm such a gas bubbling however it was quite hard to approach the exact the same point among a huge flat plane without any marker other than small rock pieces and gorgonians.

Conical Seamount (CC SMT)

The location of the peak of CC is 19º32.5’N, 146º39’E and water depth is 3140 m by SEABEAM bathymetry. As a short gramps it seems real conical shape but actually it is more deformed. The slope of the seamount at the eastern side is rather steeper than the western one and elongated NNE to SSW direction forming a broad lobe toward the SSW direction. The contour interval, at every 50 m interval, change its density at the water depth of 4000 m on the western slope whereas at 4400 m on the eastern slope. Therefore the shape of the cross section of the seamount has an inflection points on the E-W cross section. This means the two different history of an activity of serpentine mud flow of CC. At the summit area of CC shows irregular shape at the SW corner to have an elongated small ridge-like nose.

Many dives by US submersible Alvin and dives #179 and #785 by Shinkai 6500 show the many small ridge and trough structure that was formed by the serpentine mud flow with carbonate chimneys. During #179 dive notable elongated lobe structure, which consists of fresh serpentine mud flow with boulder of peridotite blocks, were observed. Many carbonate chimneys around 2 m high and several tens of cm wide stood at the summit slope of CC. One of the chimneys US team found the existence of a giant sea anemone fixed on the apex of the chimney and after 6 year later it was found again to be alive on the same chimney. During #785 we tried to find the same one that is 17 years since the first finding but it was hard to find it. We actually found a giant sea anemone sitting on the chimney however it is hard to recognize it to be that one. The situation of carbonate chimneys were changed a little bit manganese coating on the surface of the carbonate and new white carbonate grew from the older roots but smaller than that of older one. We did not find the shimmering of any seepage at the carbonate chimney site.

Coni-Pac Triangle (CPT)

The Coni-Pac Triangle (CPT) is not a serpentine seamount but mostly consisting of serpentine mud flow deposit. It elongates NW-SE direction about 20 miles with two notable parallel ridges that were observed in our bathymetric map. The CPT forms really a triangle shape surrounded by Conical Seamount, CPT east wall and north wall. The deepest point of the CPT is 5800 m. The northern and eastern walls of the CPT form steep cliff having a repeated combination of a rather steep wall and a gentle slope that is composed mostly of serpentine mud flow and older semi-consolidated pelagic sediments. The outcrops of well-stratified formation dipping toward the down slope that is SW direction were observed during #178 dive (Patty Fryer was an observed).

We intend to visualize the geology of the upper wall and summit of the ridge during #786 dive. We landed at water depth of 4830 m that is almost the same depth of Fryer’s last stop during the #178 dive. The slope however covered with thick pelagic sediments showing a notable ripple mark on the surface therefore it was hard to find the outcrop. Slope itself may consist of a repeated serpentine mud flow mostly buried by recent pelagic sediments and partly older semi-consolidated mudstone with manganese crust on the surface. The dip of the serpentine flow deposits was down dip toward NW to W.

About 10 pieces of rocks were collected from the slope and most of them were altered dolerite, sedimentary rocks. A few fragments of peridotite will be found from the scooped samples and serpentine mud flow deposit during the shorebased study, I hope.

We found several new or unknown SS during this cruise with SEA BEAM Ms Pacman, Quaker, Blue Eye between Conical and BB and three unknown SS UNK-1, UNK-2, UNK-3, and Nagaimo SMT at East of BB and CL.

> Patricia Fryer used the name “Quaker”, Blue Eye, deep Blue etc for the seamount but we have no idea where they are, so we used instantaneous field name for each unknown seamount.

Genetic consideration of forearc serpentine seamount

One thing we should take into account is the tectonic stress field of the Mariana arc-trench system. In such a case it seems significant that several huge seamount and seamount chain collide with arc. At least five such cases are identified from the bathymetric map. At 21º30’N, 20º20’N the extension of CC and north wall, 19º30’N east off PC, 18º30’N around BB, 16ºN around CC.

The other thing to think about is the basement of the forearc. If we look at the bathymetric map carefully, the contour of 5000 m is concave toward the arc at around BM and 4000 m contour is concave toward arc around CT and TQ. West of BB to CPT broad forearc basin occupies east of Agurigan Island to Pagan and here the outer arc high is not seen. In case of Izu-Bonin ODP drilling it was clear that the outer arc high consists of boninitic andesites of the older arc, about 30 Ma, once a volcanic front. The width of the area covered from 4000 m and 5000m contours gradually wider northward from east off Guam, widest at around BM and PC then gradually narrower to the north. The notable feature of the seamount is the shallowest part exist at BB and south of CPT forming an island-like feature

Origin and development of serpentine seamount

The origin of serpentine mud flow is estimated as follows; subducting old, cold oceanic plate yields much fluids and supplies them to the overlying forearc mantle wedge peridotite to form serpentine by the reaction under the low temperature and high pressure conditions. The density of water saturated serpentine-hosted peridotite mass including volatile component started to migrate upward and yield serpentine flow deposits on the seafloor at the forearc area. The repeated accumulation of serpentine flow makes an edifice high like strato-volcanoes. The volatile component will react and mixes with seawater at the surface condition to have a carbonate chimney or carbonate encrust.

The start of the formation of seamount is estimated just after the subduction started, may be 1 or2 million delay from the initiation of subduction. In case of MATS sometime 43 Ma or around 40 Ma the first serpentine seamount was formed. As the activity of the serpentine mudflow is episodic, submarine erosion takes off the soft fragile serpentine sediments and makes a flat top. Then second activity will make a new edifice on the old basement and forms inflection point on the bathymetric map.

Fault movement and possible explosion of gas yield the slope failure with huge mass wasting on the seamount edifice to form irregular ridge and trough structure, and subsequent erosion will make a notable canyon structure on the surface. If the duration of the inactive or non-active term is long, manganese oxides coats the surface of the flow and carbonate chimneys.

As for the origin of volatile component it is estimated that the carbon from the dead planktons buried into pelagic sediments, hydrogen from the result of the reaction of serpentinization, fluids from the sediments and rocks of subducting lithosphere and mantle origin gas will be mixed up.

During ascent of water saturated serpentine mud surrounding rocks pre-existing beneath the forearc, such as sedimentary rocks, gabbros, and basalts if they were there will be captured in the serpentine flow as xenoliths. The microbe will be also captured into the serpentine mud. Therefore we can estimate the lower limit of the living microbe under the forearc, that is the lower limit of deep biosphere by an elaborated microbiological study of serpentine mud. Careful analyses of mineral assemblages of metamorphic rocks from the serpentine mud will sheds light to the depth and thermal information from where the serpentine mud formed.

Large morphology on the forearc slope

Given the large topographic map of the Mariana area which was made by the compilation of our 2003 and 2006 bathymetric map and GRID map, at every 30 second square data compilation covering all the Mariana area, it is notable large horseshoe morphology at Coni-Pac Triangle, west of Big Blue SMT, west of Turquoise SMT, west of Blue Moon and Deep Blue SMT and north of North Chamorro SMT, respectively. These slope features are likely to be a huge slope failure like Costa Rica margin where many seamounts belonging to the Galapagos Hotspot attached the forearc slope to cause giant slope failures and resultant formation of the tectonic erosion. Each SS and assemblage of SS is both show a sliding nature on the slope to make a topographic depression behind the SS and topographic high in front, trench ward side. Some of the SSs seem to be not in situ seamount, that is once formed at the shallower part of the forearc slope say nearby the outer arc or outer arc high of the Mariana Arc. Only two SS, Conical and South Chamorro stand on the initial position. We have to get an elaborated study on this point near future. We propose the following scenario for the evolution of the serpentine seamount of the Mariana forearc.

Tectonic evolution of the Mariana forearc serpentine seamount

We propose here a large slope failure along the Mariana forearc. Serpentine seamount slide from the initial location to the present site. The origin of the slope failure may be caused by the continuous subduction and collision of the Dutton Seamount Chain from about 6 Ma. The failure was cause even the outer arc from around 17 degree 30 minutes to 20 degree where horseshoe morphology is notable.

A possible scenario of the evolution of Mariana forearc SS

Originally first serpentine seamount was formed about 6 Ma when the Mariana Trough was formed. The location of proto SS was estimated at nearby the outer arc high, because the angle of the subducting Pacific slab was estimated gentler compared to that of the present. The Pacific slab was then rolled back with time by the rapid spreading of the Mariana Trough yielding an extensional stress regime in the Mariana forearc region and the serpentine seamount came from the wedge upper mantle to build the seamount repeatedly along the forearc.

At almost the same time large seamounts on the Dutton Ridge, a kind of hotspot lines started subduction and collision with the Mariana Trench to cause a huge slope failure especially mobile serpentine seamount. SS consists of two major part, soft and slippery serpentine mudflow deposits and brittle blocky serpentinized peridotite mass. The boundary of soft serpentine mud may slide on the forearc slope with the slope failure caused by the seamount subduction.

A puzzling tectonic and sedimentary mélange were reported everywhere in the world accretion ally prism such as Franciscan formation and other Japanese suture zones. The origin of the mélange for the field geologists who were working mainly on land was enigma for a long time. Here we propose the process of the mélange in this region. We obtained a few serpentine mélange like metamorphose serpentinites from the North Chamorro Seamount. The scenario which to make this mélange-like rock is that first stage of serpentine mud volcano was formed then slided down to the trench floor and mixed with pelagic sediments and blocks of the oceanic plate origin. The mixture came back to the deeper part of the Mariana forearc then mixed with serpentine mud then uplifted form the present serpentine seamount. We estimate to get this kind of rocks everywhere from the Mariana.

Deep Sea Drilling Project, DSDP site 451 at the foot of the west Mariana Ridge there reported many chaotic polymict breccia. We had no idea for the formation of these breccia with serpentinites. Also we got many serpentine mélange like rocks from Yap and Palau forearcs during the submersible dives. These rocks also had the similar effect those from the Mariana forearc serpentine seamount. Fujioka, 1995 report the serpentine-dominated tectonics around Izu-Bonin-Mariana, Tonga and possibly south Sandwich subduction zones.

Petrography

Written by H. Maekawa, Y. Osada, and Y. Wada

During Dive # 369 to #375, 137 rock samples were recovered. Serpentinite and serpentinized peridotite are predominant in the Conical (#369), Pacman (#370), Twin Peaks 3 (#373), Turquoise (#374), and North Chamorro Seamounts (#375), whereas igneous rocks, such as gabbro, dolerite, and basalt, are main constituents in the eastern ridge of Big Blue Seamount (#372) and Unknown 1 Seamount (#371). Microscopic observation is necessary to determine rock types and constituents minerals more precisely. Rocks obtained from each dive are as follows;

Dive #369 (Conical Seamount)

3 serpentinized peridotites were recovered. They are highly serpentinized, but pyroxene bustites are well recognized. Primary olivine and orthopyroxene are partly survived. Harzburgite and dunite are their protoliths.

Dive #370 (Pacman Seamount)

13 serpentinized peridotites were recovered. In some samples, primary olivine and pyroxene are well preserved at their cores. Similar to the rocks from Conical Seamount, their protoliths are harzburgite and dunite. As we didn’t have any peridotite samples from Pacman Seamount, these rocks are very important for our future study.

Dive #371 (Twin Peaks 3 Seamount)

During this dive, we obtained 18 serpentinized peridotites, 3 basaltic rocks, 3 cherts, and 1 amphibolite. Serpentinized peridotites are harzburgite and dunite in origin, and include pyroxene bustites. Primary olivine and pyroxene are preserved in the core of some samples. Basaltic rocks consists of basalt, basaltic breccia, and tuffaceous rock. 2 cherts are grey to white in color, and one of them is red in color. Amphibolite is dark green in color, and acicular amphibole chrystals are visible by the naked eye. Microscopic observation is necessary to determin the constituent minerals.

Dive #372 (Eastern ridge of Big Blue Seamount)

5 serpentinized peridotites, 6 gabbros, 5 metabasalts, 4 diabases, and 2 mudstones were recovered. Metabasalt and diabase are most characteristic and predominant rock types along the Dive #372 track, and often make steep cliffs. Microscopic observation on board indicates that they have ophitic texture, and contains epidote, amphibole, and albite as metamorphic minerals.

Dive #373 (Unknown 1 Seamount)

7 serpentinized peridotites, 13 metabasalts, 2 basaltic breccias, 1 tuffaceous rock, 5 gabbros, and 2 red cherts were recovered during the dive #373. Peridotites were highly serpentinized, but some may retain primary minerals, such as spinel and orthopyroxene.

Dive #374 (Turquoise Seamount)

Most of recovered rocks are ultramafic rocks, and totall 24 serpentinized peridotites were revcovered. 2 basalts, and 1 mudstone were also obtained. Peridotites were highly serpentinized, and any primary minerals have not been retained.

Dive #375 (North Chamorro Seamount)

Similar to the Turquoise Seamount, ultramafic rocks are predominant. 12 serpentinized peridotites, 1 sheared breccia, and 1 pumice were recovered. Some serpentinized peridotites retain their primary olivines and pyroxenes. Sheared breccia has typical block-in-matrix fabrics, and consists of pebbles of metabasalt within fine-grained matrix of basalt and serpentinite materials.

Core Description

Written by K. Hirauchi and K. Fujioka

Core handling and methods for analyses

We collected the seafloor sediments on the Mariana forearc serpentine seamounts by using MBARI corer of 50 cm and 30 cm in long sizes, which were originally developed by the scientists of Monterey Bay Aquarium Research Institute. Immediately after retrieval of “Kaiko 7000 II” cores were quickly recovered from the vehicle into the Wet Laboratory. Inner core tubes were retrieved from the MBARI corer then sealed at the bottom by plastic cap then the surface water was collected for the chemical analyses. After collection of seawater sample cores remain vertically not to have disturbance during one day for dry up the interstitial waste. Next day in the laboratory, we first cut the collected cores into two halves for the description and storage that is the working half and the archive one. Next, we made smear slides at typical points in each core section, and conducted the detailed core descriptions.

We also made washed foraminiferal ooze samples for a binocular microscopic observation and made smear slides for detailed observation of major lithologies as for the constituent materials.

Results

The seafloor sediments collected are roughly divided into pelagic sediments with white particles of foraminifer tests and grayish blue serpentine muds. Surface 1-2 cm sediments show oxidized layer, consisting of olive black sandy muds, in some core sections. The pelagic sediments consist mainly of dark yellowish brown to pale (dusty) yellowish brown muddy sands with the scattered foraminifers, which are relatively abundant particularly in the lower part of the core sections. They also include irregularly scattered black erratic pebbles (up to 5 cm in size) possibly of serpentinites.

There are sedimentary structures such as normal grading (medium to fine sand size) and slightly and thinly parallel lamination in the pelagic units, in some instances, they are characterized by the alternation of sand layers having slightly different types of color. The pelagic sediments also contain continuously thin layer (1 cm in thick) of moderate yellowish brown muds with brown mottled parts. We also discovered unknown soft sediments, consisting of pale yellowish brown coccoid mud with minor foraminiferal test, on the seafloor without current ripples at the North Chamorro Seamount.

The serpentine muds were collected at the Conical, Big Blue, and Unknown 1 Seamounts during this cruise. The serpentine muds locally cropped out on the seafloor, but are mostly unconformably covered with the pelagic sediments. They consist of mainly grayish (pale) blue green to dusty blue green sandy (pebbly) muds with weakly lamination, derived from almost serpentinite bodies. Angular black serpentinite fragments (up to 3 cm in size) are irregularly scattered in this core section. The beds (10 cm in thick) of moderate yellow green to moderate yellowish green sandy muds including finer serpentinite clasts are interbedded within normal grayish serpentine muds, representing a serpentine-mud flow structure. We also found a tiny particle of pyrite at the Unknown 1 Seamount, which indicate the reductive environment of the serpentine muds.

Thin unknown queer layers were recovered from the North Chamorro Seamount which represent soft and ooze like structure. Binocular observation of this queer sediments seems like a egg of some animals or foraminifers living there. However we have no idea for this thin layers.

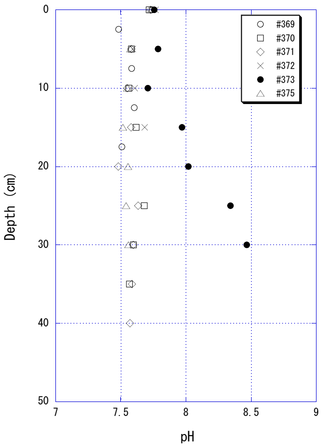
Pore-water geochemistry

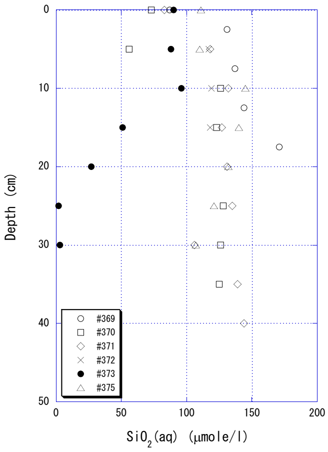
Written by H. Chiba

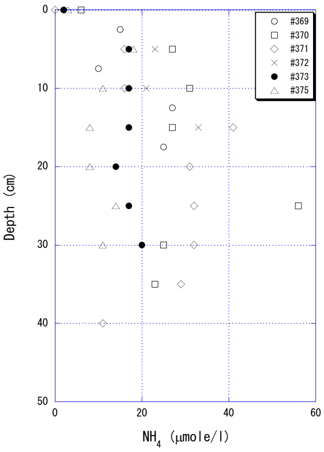
Sediment cores for pore-water study were sampled by dives #369(Conical Smt.), #370 (Pacman Smt.), #371 (Twin Peak3), #373 (Unknown 1, "Nagaimo"), #375 (North Chamorro Smt.) using 50cm long MBARI corer. The short core sampled by the dive #372 (Big Blue Smt.) using 30cm MBARI corer was shared with sedimentologists. The core of #369 dive was failed to open during treatment onboard. Thus, the seawater may be mixed with pore-water. The 1/3 of the bottom part of the #375 core was lost during handling at the seafloor and the core arrived on deck was settled to the bottom of the corer. Therefore, this sample probably lost the pore-water before sample recovery.

During this cruise, pH and SiO_2(aq) and NH_4^+ concentrations of squeezed pore-water samples were measured onboard. Relationship between depth and these parameters are plotted in the following three figures.

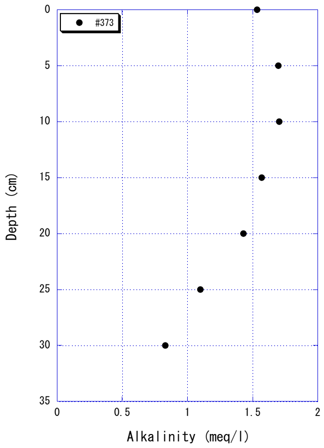
Among six cores, pore-waters of five cores show no significant change in these parameters with depth. On the other hand, the pore-water of the core sampled by dive #373 shows increase in pH and decrease in SiO_2(aq) concentration with depth. These changes with depth agree with the results reported for the pore-water chemistry at Conical Seamount and South Chamorro Seamount. Therefore, there is a high possibility that the unknown seamount 1, so-called "Nagaimo", hosts the cold seep activity at present. For the pore-water samples from this seamount, alkalinity was also measured onboard. The result is plotted against depth in the figure of the next page.







The alkalinity decreases with depth. This is an opposite trend reported for the cold-seep fluid in Conical Seamount and North Chamorro Seamount (Fryer et al., 1999). However a magnesium-depleted endmember estimated for the cold seep at Baseball Mit in Pacman Seamount has low alkalinity compared with ambient seawater (Fryer et al., 1999). Therefore, the nature of the pore-water sampled at the unknown seamount 1 (dive #373) may be similar to the pore-water in Pacman Seamount.



The difference in pore-water chemistry was considered to be related to the distance from the trench axis, in other words, the depth of descending slab, according to Fryer et al. (1999). Beneath the seamount close to the trench, only the compaction, dessication and diagenetic reactions take place in the descending slab and no decarbonation occurs. Therefore, the fluid squeezed from the slab has no carbonate in it. The unknown seamount 1, “Nagaimo” is the closest seamount to the trench among the seamounts ever sampled for the pore-water chemistry. Its pore-water chemistry likely reflects the reaction beneath the seamount. Whether the pore-water chemistry measured for this seamout really indicates the cold-seep activity or not will be confirmed by the further chemical analyses of sensitive components, such as chloride, magnesium, etc., on shore.

The pore water chemistry of other five seamounts does show no symptom for the cold seep activity. Except the sediment sample at Big Blue Seamount (dive #372), other sediment samples consist of coarse sand including a lot of calcareous ooze. It means that the sites at which we sampled for sediments cores are not active in serpentine flow activity for long time and not host the cold seep activity at present.

To conclude the pore-water geochemistry preliminary, symptom of cold seep activity at serpentine seamounts is observed only in the unknown 1 seamount, “Nagaimo”, among six seamounts we visited during the KR06-15 cruise.

							total = 9	total = 16
dive#372		(ml)	pH	Si(μmol)	NH_4^+(μmol)			
sea water	18 cm	20	7.767				1 (filtered)	
top	5 cm	4.4	7.593	117	23		1 (pH measured)	2(squeezed , not used)
middle	10 cm	4.2	7.607	119	21		1 (pH measured)	2(squeezed , not used)
bottom	15 cm	2.6	7.684	118	33		1 (pH measured)	3(squeezed , not used)
							total = 4	mix1(sequeezed)
								total = 8
dive#373		(ml)	pH	Si(μmol)	NH_4^+(μmol)	alkalinity (mmol)		
sea water	30 cm	20	7.757	90	2	1.5346	3(filtered)	
No.0(top)	5 cm		7.786	88	17	1.6980	3(alkalinity , pH measured , not used)	2(sequeezed)
No.1	10 cm		7.708	96	17	1.7048	3(alkalinity , pH measured , not used)	3(sequeezed)
No.2	15 cm		7.970	51	17	1.5702	3(alkalinity , pH measured , not used)	3(sequeezed)
No.3	20 cm		8.019	27	14	1.4300	3(alkalinity , pH measured , not used)	3(sequeezed)
No.4	25 cm		8.342	2	17	1.0998	3(alkalinity , pH measured , not used)	3(sequeezed)
No.5	30 cm		8.467	3	20	0.8310	3(alkalinity , pH measured , not used)	2(sequeezed)
							total = 21	total = 16
dive#374	no sample							
dive#375		(ml)	pH	Si(μmol)	NH_4^+(μmol)			
sea water		40	7.734	111	3		1 (not used)	2(sequeezed , not used)
No.1	5 cm	11.5	7.574	110	18		1 (pH measured)	2(sequeezed , not used)
No.2	10 cm	4.2	7.550	145	11		1 (pH measured)	2(sequeezed , not used)
No.3	15 cm	7.2	7.516	140	8		1 (pH measured)	2(sequeezed , 15~bottom)
No.4	20 cm	10.7	7.556	132	8		1 (pH measured)	1(sequeezed)
No.5	25 cm	6.4	7.541	121	14		1 (pH measured)	1(sequeezed)
No.6	30 cm	6.6	7.558	107	11		1 (pH measured)	1(sequeezed)
							total = 7	total = 11
							grand total = 58	grand total = 77

VI. Shore base study

Hirokazu Maekawa (Petrology)

1. Metamorphic evolution beneath the Mariana forearc, western Pacific.
Hirokazu Maekawa et al.

Since high-pressure/low-temperature metamorphic rocks were found from Conical Seamount during ODP Leg 125, our understandings on the idea of subduction zone metamorphism appear to have made large progress. However, there still remains an ambigrous and controvertial problem. Newly found blueschist clasts from South Chamorro Seamount (ODP Leg 195) are strikingly different in metamorphic conditions from the previously found blueschsit-facies clasts from Conical Seamount. In this paper, we will describe metamorphic rocks obtained from the seven seamounts during this cruise, clearlify the nature of Mariana subduction metamorphism and establish the Mariana blueschist-facie metamorhpic belt beneath the forearc.

2. Serpentinization of wedge mantle peridotites beneath the Mariana forearc.
Hirokazu Maekawa et al.

We will examine the serpentine mineral associations of serpentinized peridotites from seven seamounts investigated in this cruise and those from South Chamorro Seamount recovered from ODP Leg 195, clarify the distributions of rocks with antigorite-bearing or antigorite-free assemblages, and inspect our hypothesis that antigorite only occurs in seamounts far from the trench (more than 80 km).

3. Cooling history of wedge mantle peridotites in the Mariana forearc.
Keiko Murata (Kobe Women's Univ.) and Hirokazu Maekawa et al.

Using geospeedmeter (Ozawa, 1983), we will estimate cooling history of peridotites for each serpentinite seamount investigated in this cruise. We already obtained the cooling rates of 10^{-2}~10^{-4} ºC/year for peridotites both from Conical and South Chamorro Seamounts. In this paper, will compare the retes with peridotites from other seamounts investigated in this cruise, and discuss the significance of the cooling within the subduction zone in general.

Kantaro Fujioka (Geomorphology, Paleomagnetism)

Oral Presentation
JAMSTEC Blue Earth Symposium (March)
Morphologic study of serpentinites seamounts in the Mariana Trench
Kantaro Fujioka, Hisayoshi Yokose, Hitoshi Chiba, Hirokazu Maekawa, Rie Ishii and Morihisa Takaesu (NME)

Japanese Geophysical Union (Godo-Gakkai) May
Geological Soceity of Japan Annual Meeting September, Sapporo

2007 AGU Fall at San Fransisco

Research papaers

1. Topography and geology of Mariana forearc serpentine seamount
Kantaro Fujioka, Hisayoshi Yokose, Ken-ichi Hirauchi, Yuta Fujimoto, Hajime Sato, Rie Ishii, Sakaguchi, Motofumi Takaesu and Hirokazu Maekawa

2. Magnetic properties of the Mariana forearc serpentine seamount
Kantaro Fujioka, Motofumi Takaesu, Masato Joushima, T. Kanamatsu and H. Oda

3. Rock and sediment magnetism of the Mariana forearc serpentine seamount
Kantaro Fujioka, T. Kanamatsu, and Ken-ichi Hirauchi

Yokose Hisayoshi (Marine geology, Tectonics)

1. Geology of the Mariana fore arc region
Yokose et al.

To understand the general geology of the Mariana forearc, we will synthesis with newly acquired bathymetric data, both KR06-15 and YK03-07 cruises, and seven dive observations from Kaiko 7000 II, lithological characteristics. This paper will be focused on the geological description of this area.

2. Growth model for the serpentine seamounts on the Mariana fore arc region
Yokose et al.

Nine serpentine seamounts on the eastern flanks of the Mariana fore arc region have been discovered. However, their topographical features have been discussed insufficiently due to low resolution of the bathymetric data. High resolution bathymetric surveys carried out during KR06-15 and YK03-07 cruises and revealed topographical details of the seamounts. They show three basic topographical types: plateau, conical, and bell shape. The types could be depended on the physical properties, such as viscosity, effusion rate, and yield strength, of the serpentinite flows. Therefore the differences are expected to reflect its development history and effusion style. The shape analysis will offer a realistic model for serpentinization and transportation processes in the wedge mantle.

Hitoshi Chiba and Nanami Maeda (Pore-water and stable isotope geochemistry)

1. Pore-water geochemistry of the Mariana serpentine seamounts (Data report).
The pore water samples collected during the cruise will be measured for their major chemical components and sulfur isotope ratios of sulfate ion. The data will be reported as a data report together with the already measured data of pore water samples collected in the YK03-07.

2. Stable isotopic behavior during serpentinization of peridotite at Mariana forearc region.
Serpentine blocks having peridotite core has recovered during KR06-15 cruise. These blocks provide us an opportunity to study stable isotopic change during serpentinization of peridotite. Stable isotopic measurements will be done from core to rim, samples in various degree of serpentinization. The results will show a general stable isotopic trend during serpentinization. Also several stable isotopic geothermometer will be applied to these samples to estimate the temperature

of serpentinization reaction.

Koshi YAMAMOTO (Petro-Geochemistry)

During KR06-15 Cruise, red and gale green chert fragments have been recovered by dive #371 (Twin Peaks 3 SMT). Depositional environment of chert may provide us important information about incorporation mechanism of clastics into serpentine seamount. Depositional environment of chert can be estimated by MnO/TiO_2 and Co/TiO_2 ratios (e.g. Yamamoto, 1991) and Ce anomaly in the rare earth element (REE) pattern (Shimizu et al., 1982). In this study, major and trace elements will be analyzed by the XRF method (Shimadzu SXF 1200) and REEs by ICP-MS (HP4500) in order to discuss the depositional environment of recovered chert samples.

Basaltic samples are also included among many serpentinized ultramafic rocks. Occurrence frequency of basaltic rocks in serpentine seamount seems to increase from arc side to subduction side. To know the nature of basaltic rocks is the basic information to discuss the formation mechanism of seamount. Major and trace (including REEs) elements will be analyzed in order to clarify petrologic nature of basaltic samples. If needed, some samples will be dated by the Rb-Sr or Sm-Nd systematics.

Serpentine blocks having peridotite core has recovered by the dive #370 (Pacman SMT). This block provides us a chance to discuss elemental mobility during serpentinzation of peridotite. Elemental profile from the peridotite core to sepentine rim may give basic data to investigate elemental mobility, e.g. leaching out from the block and adsorption from ambient seawater. Seven pieces cut from fore to rim will be analyzed for major and trace (including REEs) elements to obtain elemental profile.

Yutaka WADA (Petrology)

First of all, from all of the seamounts where KAIKO-7000II visited we could recover serpentinite block samples during KR06-15 cruise. To determine mineral assemblages of serpentinite blocks is necessary to understand the formation process of the sepentinite seamount. Several serpentinite blocks with relic peridotite core were recovered from dive #370. If we can apply geothermometry and geobarometry to the relic core minerals of peridotite, we may infer pressure and temperature for their occurrence. This is also important to make the formation process of serpentinite seamounts clear.

From the dives #371, 372 and 373 blocks of basaltic volcanics such as basaltic pillow lava, tuff breccia, and dolerite were obtained. Gabbros and cherts samples were also recovered. These may suggest that materials derived from oceanic crust are involved into some seamounts, and/or the materials from oceanic crust themselves compose some of seamounts. Detailed studies of rock facies variation during dives, and chronological and chemical analyses are necessary.

Ken-ichi HIRAUCHI (Structural Geology)

Geophysical studies have verified that serpentinites are common along plate boundaries in some parts of forearc mantle wedge in subduction zones, particularly in the depth of several tens of kilometers, from their specific properties having low seismic velocity and high poisson’ s ratio (Kamiya and Kobayashi, 2000; Zhao et al., 2001; Bostock et al., 2002). Water supply by dehydration reactions of subducting slab may induce serpentinization into overlying forearc mantle wedge (Hyndman and Peacock, 2003). Such serpentinites are known for the materials to control slip styles along the plate boundaries, since the serpentinite-rich zones coincide with aseismic areas (Kamimura et al., 2002; Brocher et al., 2003).

Experimental studies have indicated that some serpentinites behave aseismic slip under shallow level supporting the assumption for such geophysical results (Moore et al., 1996, 1997; Reinen, 2000). According to such seismic evidence and mechanical properties, serpentinites are working as a lubricant along the plate boundaries.

Serpentinite areas (9-20 km) along the plate boundary in the Izu-Bonin subduction zone inferred by Kamimura et al. (2002) coincide with the areas characterized by few large earthquakes. In addition, Kamimura et al. (2002) indicated that the diapiric intrusion of these serpentinites occurs into the serpentinite seamount located at the trench slope. However, few examples of such serpentinites have been subject to detailed macroscopic and microscopic structural, textural, and petrological analyses, although the serpentinites may retain the geologic evidence for aseismic slip along the plate boundary.

This study concerns the debris flow of the Mariana forearc seamounts, consisting of nodule-like blocks and muds, derived from the pre-existing serpentinite body. At first, textural, structural and mineralogical variations in the blocks are used to explore the metamorphic history including the stages of serpentinization, high-temperature metamorphism represented by antigorite replacements, and ductile to brittle progression of deformation such as dynamic recrystallization and cataclastic flows. Next, the serpentine mud-flow may have evidence for a strong shearing, because of its mechanical weakness. Microscopic and SEM observations to relatively large grains in the serpentine-flows are done to elucidate dominant serpentine minerals, the existence of anisotropy such as shape-preferred orientation, and the structural relationship of the blocks. Furthermore, I realize the serpentine behavior of grains surviving in the mud-flows different from that of the blocks.

Serpentine minerals (lizardite, chrysotile and antigorite) are detected by X-Ray diffraction analysis and Raman spectroscopy, which enables to identify the individual serpentine minerals under microscopic scale.

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List of rock samples and photographs Dive #369

Rock Samples collected from Conical Seamount during KR06-15 #369 **Date 2006/11/28**

Sample No.	Size (cm)			Weight (kg)	Rock Name	Mode of occurrence	Location	Remarks	Distribution
#369-R-01-01	20	14	13	5.98	Serpentinite peridotite (harzburgite)	block	St.1	olivine and opx are survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#369-R-01-02	26	14	10	6.2	Serpentinite	block	St.1		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#369-R-03-01	34	19	16	8.7	Carbonate	chimney	St.3	Thin Mn-coating	H.,Chiba, all
#369-R-04-01	18	12	9	2.5	Serpentinite	block	St.4	Opx is survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#369-pebble and sand				1.6			St.1 and 4		H.,Maekawa, 1/2 K.,Fujioka+K.,Hirauchi, 1/2

List of rock samples and photographs Dive #370

Rock Samples collected from Pacman Seamount during KR06-15 #370 **Date 2006/11/29**

Sample No.	Size (cm) Weight (kg)				Rock Name	Mode of occurrence	Location	Remarks	Distribution
#370-02R-01	12	10	7	0.6	serpentinite (dunite)	block	St. 2		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#370-02R-02	21	21	14	5.5	serpentinite (harzburgite)	block	St. 2	Olivine and opx are survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#370-03R-01	16	14	10	2.3	serpentinite (harzburgite)	block	St. 3	Opx is survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#370-03R-02	13	9	4	0.3	serpentinite (harzb.) + semi-consolidated serpentinite mud	block	St. 3		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#370-03R-03	14	10	9	1.2	serpentinite (harzburgite)	block	St. 3	Opx is survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#370-03R-04	12	12	8	0.9	serpentinite (dunite)	block	St. 3		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#370-04R-01	12	9	6	0.5	serpentinite (dunite)	block	St. 4		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#370-04R-02	12	11	10	1.3	serpentinite (dunite)	block	St. 4		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#370-04R-03	10	9	7	0.2	serpentinite (dunite)	block	St. 4		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#370-06R-01	18	17	11	3.4	serpentinite (harzburgite)	block	St. 6	Olivine and opx are survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#370-06R-02	9	6	5.5	0.5	serpentinite (dunite)	block	St. 6		H.,Maekawa
#370-07R-01	16	12	10	2.2	serpentinite (harzburgite)	block	St. 7	Olivine and opx are survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#370-07R-02	17	12	10	2.2	serpentinite (dunite)	block	St. 7	Opx is survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#370-pebble and sand				0.5			St. 1 and 2		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3


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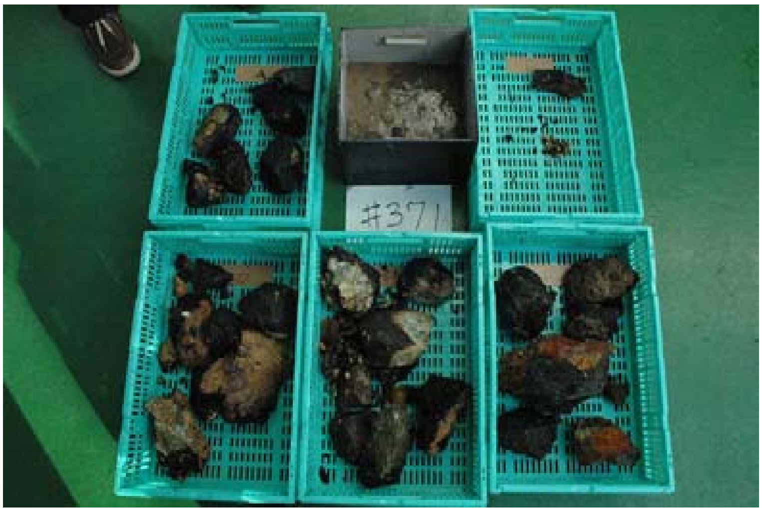
List of rock samples and photographs Dive #371

Rock Samples collected from Twin Peak 3 Seamount during KR06-15 #371 **Date 2006/11/30**

Sample No.	Size (cm) Weight (kg)				Rock Name	Mode of occurrence	Location	Remarks	Distribution
#371-01R-01	13	10	8	1	basaltic tuff breccia	block	St. 1		H.,Maekawa, 7/15 K.,Fujioka+K.,Hirauchi, 1/3, Y.,Wada, 1/5
#371-01R-02	10	10	8	0.6	serpentinite	block	St. 1		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-02R-01	16	11	10	1	serpentinite	block	St. 2	orthopyroxene is survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-03R-01	5	4	3	0.1	serpentinite	block	St. 3		H.,Maekawa, all
#371-03R-02	16	12	11	2.8	serpentinite	block	St. 3	orthopyroxene is survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-04R-01	16	10	11	2	serpentinite	block	St. 4		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-05R-01	15	13	8	2.2	serpentinite (harzburgite)	block	St. 5	Mn crust 0.3-1.0mm	H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/3, K.,Yamamoto, 1/6
#371-05R-02	11	11	6	0.8	serpentinite (dunite)	block	St. 5	sheared	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-05R-03	14	7	6	0.6	serpentinite	block	St. 5		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-06R-01	14	11	8	1.4	altered basalt	block	St. 6		H.,Maekawa, 1/2 K.,Fujioka+K.,Hirauchi, 1/3, Y.,Wada, 1/6
#371-06R-02	10	8	7	0.8	serpentinite	block	St. 6	orthopyroxene is survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-07R-01	15	9	8	1.2	serpentinite (harzburgite)	block	St. 7	olivine and orthopyroxene are survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-07R-02	11	10	12	1.8	serpentinite	block	St. 7	orthopyroxene is survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-07R-03	11	10	7	0.8	serpentinite (dunite)	block	St. 7		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-08R-01	20	15	12	4.6	amphibolite	block	St. 8		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-08R-02	23	14	8	2.6	serpentinite (harzburgite)	block	St. 8	olivine and orthopyroxene are survived at the core	H.,Maekawa, all
#371-09R-01	12	7	7	0.4	serpentinite	block	St. 9		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-09R-02	16	11	10	1.4	chert	outcrop	St. 9		H.,Maekawa, all
#371-10R-01	18	12	11	1.6	serpentinite (harzburgite)	block	St. 10	olivine and orthopyroxene are survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-10R-02	14	9	4	0.4	red chert	block	St. 10	Mn crust <1mm	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-11R-01	14	9	8	1	serpentinite	block	St. 11		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-11R-02	10	6	3	0.2	serpentinite	block	St. 11		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-14R-01	19	12	8	1.4	serpentinite	block	St. 14		H.,Maekawa, all
#371-14R-02	28	16	20	8.6	basaltic tuff breccia	block	St. 14		H.,Maekawa+ H.,Chiba, 7/15 K.,Fujioka+K.,Hirauchi, 1/3, Y.,Wada, 1/5
#371-14R-03	19	9	6	2	chert	block	St. 14		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#371-pebble and sand							St. 2, St. 3, St. 11 and St. 14		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3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List of rock samples and photographs Dive #372

Rock Samples collected from Big Blue Seamount during KR06-15 #372 **Date 2006/12/1**

Sample No.	Size (cm)			Weight (kg)	Rock Name	Mode of occurrence	Location	Remarks	Distribution
#372-01R-01	12	9	6	0.7	peridotite + chert	block	St. 1		H.,Maekawa, all
#372-01R-02	9	6	4	0.2	mudstone	block	St. 1		H.,Maekawa, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-02R-01	13	11	9	1.6	serpentinite	outcrop	St. 2	orthopyroxene is survived at the core	H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-02R-02	18	16	16	5.4	serpentinite (peridotite)	outcrop	St. 2		H.,Maekawa, all
#372-02R-03	19	9	6	1.0	serpentinite	outcrop	St. 2	orthopyroxene is survived at the core	H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-03R-01	12	7	4	0.5	serpentinite	outcrop	St. 3		H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-03R-02	12	7	5	0.6	partly serpentinized gabbro	outcrop	St. 3		H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-05R-01	12	10	6	0.6	basalt	outcrop	St. 5		H.,Maekawa, all
#372-05R-02	15	12	10	1.8	serpentinite	outcrop	St. 5		H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-06R-01	12	8	5	0.6	partly serpentinized gabbro	outcrop	St. 6		H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-06R-02	18	12	11	3.8	partly serpentinized gabbro	outcrop	St. 6	sheared	H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-06R-03	6	4	3	0.1	basalt	outcrop	St. 6		H.,Maekawa, all
#372-07R-01	18	11	14	3.4	serpentinite	outcrop	St. 7	olivine and orthopyroxene are survived at the core	H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-08R-01	12	7	8	2.0	dolerite	outcrop	St. 8		H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-08R-02	12	9	6	1.0	basaltic breccia	outcrop	St. 8		H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-09R-01	3	4	2	0.3	basalt	outcrop	St. 9		H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-09R-02	4	4	4	0.1	basalt	outcrop	St. 9		H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-10R-01	9	5.5	5	0.3	basalt	outcrop	St. 10		H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-10R-02	8	8	5	0.4	basalt	outcrop	St. 10		H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-11R-01	14	7	7	0.6	serpentinite	outcrop	St. 11		H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-11R-02	19	12	13	2.8	basalt	outcrop	St. 11		H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-11R-03	25	20	15	7.0	basalt	outcrop	St. 11		H.,Maekawa+ H.,Chiba, 1/2 K.,Fujioka+K.,Hirauchi, 1/4 ,H.,Yokose, 1/4
#372-pebble and sand				5.6			St. 4		H.,Maekawa+ H.,Chiba, 1/3 K.,Fujioka+K.,Hirauchi, 1/3 ,H.,Yokose, 1/3


#372


#372-01R-01
KR06-15


#372-01R-02
KR06-15
01 DEC 2006


#372-02R-01
KR06-15


#372-02R-02
KR06-15


#372-02R-03
KR06-15


#372-03R-01
KR06-15
01 DEC 2006


#372-03R-02
KR06-15


#372-04R-01
KR06-15


#372-05R-01
KR06-15


#372-05R-02
KR06-15


#372-06R-01
KR06-15


#372-06R-02
KR06-15


#372-06R-03
KR06-15
01 DEC 2006


#372-07R-01
KR06-15
01 DEC 2006


#372-08R-01
KR06-15
01 DEC 2006


#372-08R-02
KR06-15
01 DEC 2006


#372-09R-01
KR06-15
01 DEC 2006


#372-09R-02
KR06-15
01 DEC 2006


#372-10R-01
KR06-15
01 DEC 2006


#372-10R-02
KR06-15
01 DEC 2006


#372-11R-01
KR06-15
01 DEC 2006


#372-11R-02
KR06-15
01 DEC 2006


#372-11R-03
KR06-15
01 DEC 2006

List of rock samples and photographs   Dive #373

Rock Samples collected from Unknown 1 Seamount during KR06-15 #373 **Date 2006/12/2**

Sample No.	Size (cm)			Weight (kg)	Rock Name	Mode of occurrence	Location	Remarks	Distribution
#373-01R-01	10	9	11	1.0	breccia (basalt + serpentinite + chert)	block	St. 1		H.,Maekawal
#373-01R-02	6	5	5	0.2	basalt	block	St. 1		H.,Maekawa
#373-01R-03	5	4	5	0.1	basalt	block	St. 1		H.,Maekawa
#373-02R-01	5	3	2	0.1	basalt	block	St. 2		H.,Maekawa
#373-02R-02	22	20	17	6.4	serpentinite	block	St. 2		H.,Maekawa
#373-03R-01	9	9	6	0.6	tuff breccia	block	St. 3		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-03R-02	8	6	7	0.2	altered basalt	block	St. 3		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-03R-03	9	8	6	0.4	altered basalt	block	St. 3		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-04R-01	8	6	4	0.6	altered chert	block	St. 4		H.,Maekawa
#373-04R-02	16	17	15	4.0	serpentinized peridotite	block	St. 4		H.,Maekawa
#373-07R-01	15	13	6	1.4	basalt	block	St. 7		H.,Maekawa
#373-07R-02	13	11	8	1.2	basalt	block	St. 7		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-07R-03	16	11	8	2.4	olivine basalt	block	St. 7		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-08R-01	9	8	7	1.8	serpentine	block	St. 8		H.,Maekawa
#373-08R-02	11	11	9	1.0	basalt	block	St. 8		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-08R-03	4	3	3	0.1	serpentinite	block	St. 8	orthopyroxene is survived at the core	H.,Maekawa
#373-10R-01	11	11	8	1.0	basalt	block	St. 10		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-10R-02	12	10	8	1.0	basalt (pillow lava)	block	St. 10		H.,Maekawa
#373-10R-03	8	7	6	0.6	gabbro	block	St. 10		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-10R-04	17	10	7	1.4	gabbro	block	St. 10		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-12R-01	9	4	4	0.4	serpentinite	block	St. 12		H.,Maekawa
#373-12R-02	13	11	8	1.2	serpentine	block	St. 12	orthopyroxene is survived at the core	H.,Maekawa
#373-12R-03	15	10	8	1.2	gabbro	block	St. 12		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-12R-04	7	8	4	0.4	chert	block	St. 12		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-13R-01	23	23	14	6.7	serpentinized peridotite	block	St. 13		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-14R-01	10	7	4	0.4	basalt	block	St. 14		H.,Maekawa
#373-14R-02	16	13	10	2.4	basalt	block	St. 14		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-14R-03	12	10	6	0.8	basaltic tuff	block	St. 14		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-15R-01	19	14	9	2.8	gabbro	block	St. 15		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-15R-02	11	12	12	1.8	gabbro	block	St. 15		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#373-pebble and sand				5.4			St. 3, 5, 6, 11		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3


#373


#373-01R-01
KR06-15
02 DEC 2009


#373-01R-02
KR06-15
02 DEC 2009


#373-01R-03
KR06-15
02 DEC 2009


#373-02R-01
KR06-15
02 DEC 2009


#373-02R-02
KR06-15


#373-03R-01
KR06-15
02 DEC 2009


#373-03R-02
KR06-15
02 DEC 2009


#373-03R-03
KR06-15
02 DEC 2009


#373-04R-01
KR06-15
02 DEC 2009


#373-04R-02
KR06-15


#373-07R-01
KR06-15
02 DEC 2009


#373-07R-02
KR06-15
02 DEC 2009


#373-07R-03
KR06-15


#373-08R-01
KR06-15
02 DEC 2009


#373-08R-02
KR06-15
02 DEC 2009


#373-08R-03
KR06-15
02 DEC 2006


#373-10R-01
KR06-15
02 DEC 2006


#373-10R-02
KR06-15
02 DEC 2006


#373-10R-03
KR06-15
02 DEC 2006


#373-10R-04
KR06-15
02 DEC 2006


#373-12R-01
KR06-15
02 DEC 2006


#373-12R-02
KR06-15
02 DEC 2006


#373-12R-03
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#373-12R-04
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02 DEC 2006


#373-13R-01
KR06-15
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#373-14R-01
KR06-15
02 DEC 2006


#373-14R-02
KR06-15
02 DEC 2006


#373-14R-03
KR06-15
02 DEC 2006


#373-15R-01
KR06-15
02 DEC 2006


#373-15R-02
KR06-15
02 DEC 2006

List of rock samples and photographs Dive #374

Rock Samples collected from Turquoise Seamount during KR06-15 #374 **Date 2006/12/3**

Sample No.	Size (cm)			Weight (kg)	Rock Name	Mode of occurrence	Location	Remarks	Distribution
#374-02R-01	22	16	14	3.4	serpentinite	block	St. 2		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-02R-02	11	878	5	0.6	serpentinite	block	St. 2		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-02R-03	17	7	7	0.8	serpentinite	block	St. 2		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-02R-04	24	12	13	2.4	serpentinite	block	St. 2		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-02R-05	12	7	5	0.6	serpentinite	block	St. 2		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-03R-01	12	7	6	0.4	sheared serpentinite	block	St. 3		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-03R-02	7	6	6	0.4	serpentinite	block	St. 3		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-03R-03	8	6	5	0.2	serpentinite	block	St. 3		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-03R-04	17	17	9	2.0	serpentinite	block	St. 3		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-03R-05	11	7	3	0.2	serpentinite	block	St. 3		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-04R-01	22	18	14	4.6	serpentinite	block	St. 4		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-04R-02	9	7	3	0.4	serpentinite	block	St. 4		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-04R-03	13	13	11	0.8	serpentinite	block	St. 4		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-04R-04	5	4	3	0.1	serpentinite	block	St. 4		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-04R-05	12	7	5	0.4	serpentinite	block	St. 4		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-05R-01				0.4	mud (serpentinite pebble)	block	St. 5		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-05R-02	7	6	5	0.4	serpentinite	block	St. 5		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-05R-03	18	10	9	1.0	serpentinite	block	St. 5		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-05R-04					(lost)	block	St. 5		
#374-06R-01	20	14	10	1.4	serpentinite	block	St. 6		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-06R-02	13	8	6	0.8	serpentinite	block	St. 6		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-07R-01	10	9	7	0.8	serpentinite	outcrop	St. 7		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-07R-02	17	17	11	1.4	serpentinite	outcrop	St. 7		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-07R-03	12	8	6	0.6	serpentinite	outcrop	St. 7		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-07R-04	11	8	6	0.4	serpentinite	outcrop	St. 7		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-08R-01	36	36	7	7.6	mud stone	outcrop	St. 8	living trace	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-10R-01	19	13	9	2.4	altered basalt	block	St. 10		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-11R-01	19	13	4	0.4	serpentinite	block	St. 11		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-11R-02	18	16	14	2.8	basalt	block	St. 11		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#374-pebble and sand				1.6			St. 1, 3, 8		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3


#374


#374-02R-01
KR06-15


#374-02R-02
KR06-15


#374-02R-03
KR06-15


#374-02R-04
KR06-15


#374-02R-05
KR06-15


#374-03R-01
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#374-03R-02
KR06-15


#374-03R-03
KR06-15


#374-03R-04
KR06-15


#374-03R-05
KR06-15


#374-04R-01
KR06-15


#374-04R-02
KR06-15


#374-04R-03
KR06-15


#374-04R-04
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#374-04R-05
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#374-05R-01
KR06-15
03 DEC 2006


#374-05R-02
KR06-15
03 DEC 2006


#374-05R-03
KR06-15


#374-06R-01
KR06-15


#374-06R-02
KR06-15


#374-07R-01
KR06-15


#374-07R-02
KR06-15


#374-07R-03
KR06-15


#374-07R-04
KR06-15


#374-08R-01


#374-10R-01
KR06-15

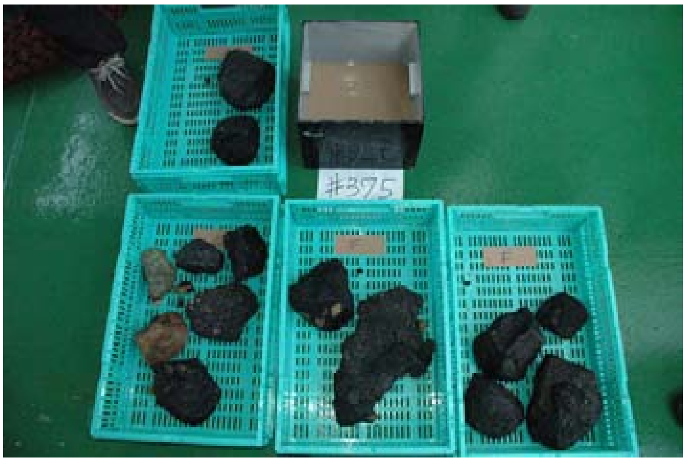

#374-11R-01
KR06-15


#374-11R-02
KR06-15

List of rock samples and photographs Dive #375

Rock Samples collected from North Chamorro Seamount during KR06-15 #375 **Date 2006/12/8**

Sample No.	Size (cm)			Weight (kg)	Rock Name	Mode of occurrence	Location	Remarks	Distribution
#375-05R-01	13	11	10	1.0	pumice	block	St. 5		H.,Maekawa, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#375-06R-01	10.5	8	9	1.0	serpentinite	block	St. 6		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#375-06R-02	15	12	16	2.8	serpentinite	block	St. 6		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#375-06R-03	12	7	8	0.8	serpentinite	block	St. 6		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#375-06R-04	33	19	9	3.0	serpentinite mud	block	St. 6		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#375-06R-05	20	14	14	4.6	serpentinite	block	St. 6		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#375-06R-06	15	11	11	2.2	serpentinite	block	St. 6	orthopyroxene is survived at the core	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#375-07R-01	14	14	11	2.6	serpentinized peridotite	block	St. 7		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#375-07R-02	16	13	8	2.0	serpentinite	block	St. 7	sheared	H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#375-07R-03	16	13	6	1.4	serpentinite	block	St. 7		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#375-07R-04	13	8	7	0.8	serpentinite	block	St. 7		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#375-08R-01	20	14	12	4.0	serpentinized peridotite	block	St. 8		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#375-08R-02	14	10	12	1.8	serpentinite	block	St. 8		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#375-08R-03	13	9	9	1.4	serpentinite	block	St. 8		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3
#375-pebble and sand				1.4			St. 2, 8		H.,Maekawa+ H.,Chiba, 2/3 K.,Fujioka+K.,Hirauchi, 1/3


#375


#375-05R-01
KR06-15


#375-06R-01
KR06-15


#375-06R-02
KR06-15


#375-06R-03
KR06-15


#375-06R-04
KR06-15


#375-06R-05
KR06-15


#375-06R-06
KR06-15


#375-07R-01
KR06-15


#375-07R-02
KR06-15


#375-07R-02
KR06-15


#375-07R-03
KR06-15


#375-07R-04
KR06-15


#375-08R-01
KR06-15

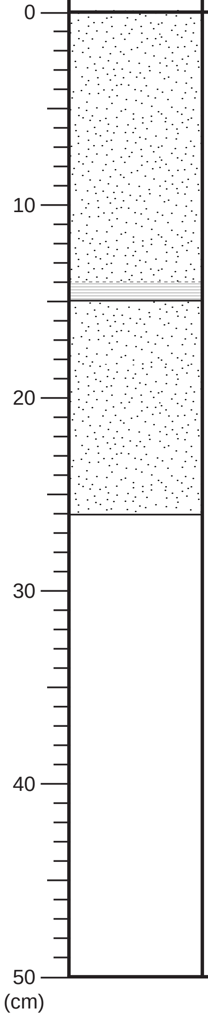

#375-08R-02
KR06-15


#375-08R-03
KR06-15

Core descriptions

MBARI Core Sample Description Format

Cruise Number KR06-15	Dive # 369	Date 2006/11/28
Location latitude 19° -32.3655'N longitude 146° -38.9371'N	Conical Seamount Station 2(MBARI30_ yellow)	



Smear Slide	Visual Core Description	Remarks
☆ 5 cm	a. 0~13 cm 5YR 4/1 Brownish gray to 5YR 2/1 Brownish black sandy mud. Foraminifers are scattered in this interval.	a. Foraminifers patch b. Black sand patch
☆ 14.5 cm	b. 13~14cm 5Y 2/1 Olive black mud continously underlying the above mud, but finer.	
☆ 20 cm	c. 14~26cm 10YR 6/2 Pale yellowish brown foraminiferal ooze with irregularly scattered black sand patch.	
End of Core 26 cm		

Total Core Length 26 cm

Observer K. Fujioka and K. Hirauchi

Dive #369 Stn. 2, MBARI30cm yellow

MBARI Core Sample Description Format

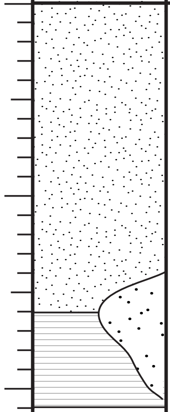
Cruise Number KR06-15	Dive # 369	Date 2006/11/28

Location latitude 19˚ -32.3655'N

longitude 146˚ -38.9371'N

Conical Seamount

Station 2(MBARI50_ green)

Depth (cm)	Lithology	Smear Slide	Visual Core Description	Remarks
0–50		☆ 5 cm ☆ 18 cm ☆ 19 cm serpentine mud End of Core 26 cm	a. 0~16 cm 5YR 4/1 Brownish gray to 5YR 2/1 Brownish black sandy mud with slightly lamination. Foraminifers are scattered in this interval. b. 14~21 cm 10GY 7/2 Pale yellowish green calcareous serpentine mud pod with sand-sized lithic fragments (serpentinite?). c. 16~21cm 10YR 5/4 Moderate yellowish brown mud with brown mottled parts.	a. Foraminifers patch b. Lithic fragments

0 10 20 30 40 50 (cm)

Total Core Length 26 cm

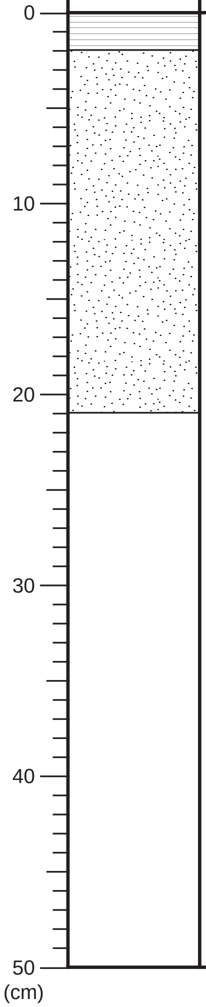
Observer K. Fujioka and K. Hirauchi

Dive #369 Stn. 2, MBARI50cm green

MBARI Core Sample Description Format

Cruise Number KR06-15	Dive # 370	Date 2006/11/29

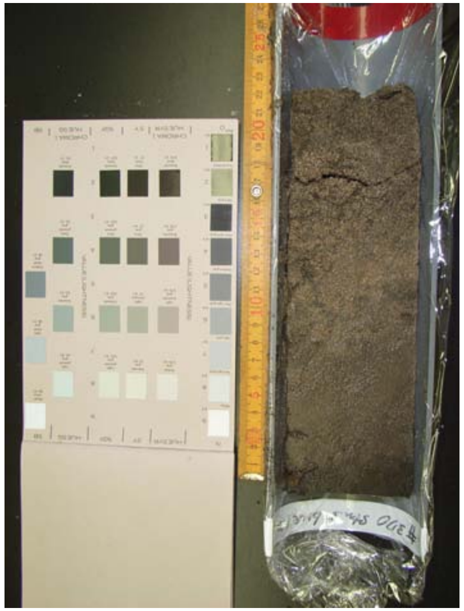
Location latitude 19° -15.5656'N longitude 146° -55.7098'E	Conical Seamount Station 5(MBARI30_blue)

Lithology	Smear Slide	Visual Core Description	Remarks
	☆ 1 cm ☆ 10 cm End of Core 21 cm	a. 0~2 cm 5YR 2/1 Olive black muddy sand. b. 2~21 cm 10YR 4/2 Dark yellowish brown to 10YR 2/2 Dusty yellowish brown color sand with normal grading (medium to fine sand size), and including foraminiferal ooze, particularly in the lower part.	a. Surface 2 cm is oxidized layer. b. Reworked foram sandy mud with normal grading. c. Washed foraminiferal ooze at 16cm for binocular microscopic observation.

Total Core Length 26 cm

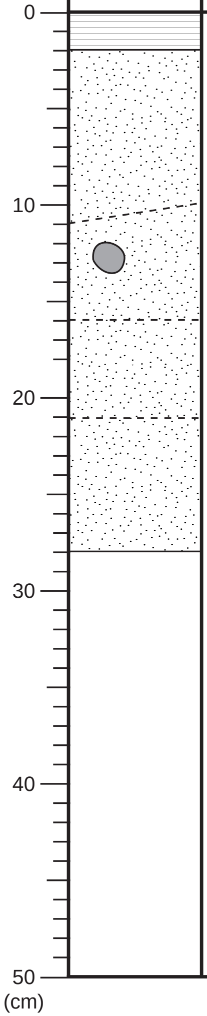
Observer K. Fujioka and K. Hirauchi

Dive #370 Stn. 5, MBARI30cm blue



MBARI Core Sample Description Format

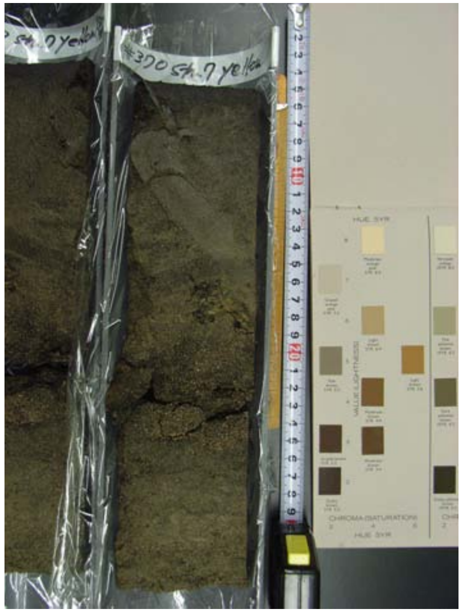
Cruise Number KR06-15	Dive # 370	Date 2006/11/29
Location latitude 19° -15.4659'N longitude 146° -55.7875'E	Conical Seamount Station 7(MBARI30_ yellow)	

Lithology	Smear Slide	Visual Core Description	Remarks
	☆ 1 cm ☆ 12 cm ☆ 25 cm End of Core 28 cm	a. 0~2 cm 5YR 2/1 Olive black muddy sand. b. 2~11 cm Alteration of 10YR 4/2 Dark yellowish brown sand and 10YR 6/2 Pale yellowish brown sand with foramniferal ooze and erratic pebbles. c. 11-21 cm 10YR 2/2 Dusty yellowish brown sand with Foraminiferal ooze at the base, showing grading upward (medium to fine sand size). d. 21-28 cm 10YR 7/4 Grayish orange to 10YR 5/4 Modelate yellowish brown colored thinly laminated muddy sand with scattered foraminiferal test throughout.	a. Surface 2 cm is oxidized layer. b. 10.5-13 cm Erratic pebble c. 15-18 cm Erratic pebble

Total Core Length 28 cm

Observer K. Fujioka and K. Hirauchi

Dive #370 Stn. 7, MBARI30cm yellow

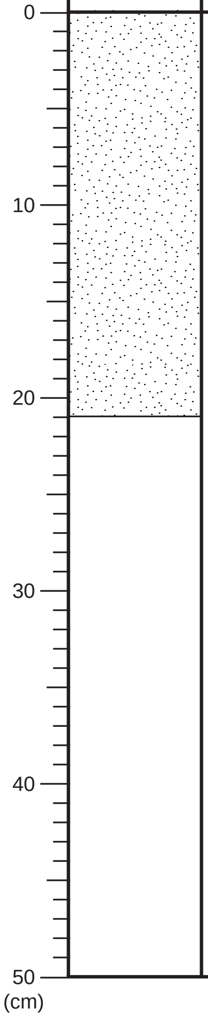


MBARI Core Sample Description Format

Cruise Number KR06-15	Dive # 371	Date 2006/11/30

Location
latitude 18° -35.8274'N
longitude 146° -58.5963'E

Twin Peaks 3 Seamount
Station 2(MBARI30_ black)



Lithology	Smear Slide	Visual Core Description	Remarks
	☆ 3 cm End of Core 15 cm	a. 0~15 cm 10YR 7/4 Grayish orange to 10YR 4/2 Dark yellowish brown muddy sand showing fine-graining upward. Foraminiferal test and elastic serpentinite clasts (>5cm in size) are scattered in this core section.	a. foraminiferal test b. angular serpentinite clasts

Total Core Length 15 cm

Observer K. Fujioka and K. Hirauchi

Dive #371 Stn. 2, MBARI30cm black

MBARI Core Sample Description Format

Cruise Number KR06-15

Dive # 371

Date 2006/11/30

Location latitude 18° -35.4002'N
longitude 146° -58.3430'E

Twin Peaks 3 Seamount

Station 11(MBARI30_ blue)

Lithology	Smear Slide	Visual Core Description	Remarks
	☆ 5 cm End of Core 10 cm	a. 0~10 cm 10YR 7/4 Grayish orange to 10YR 4/2 Dark yellowish brown muddy sand showing fine-graining upward. Foraminiferal test are scattered in this core section.	a. Top most is missing.

0 10 20 30 40 50 (cm)

Total Core Length 10 cm

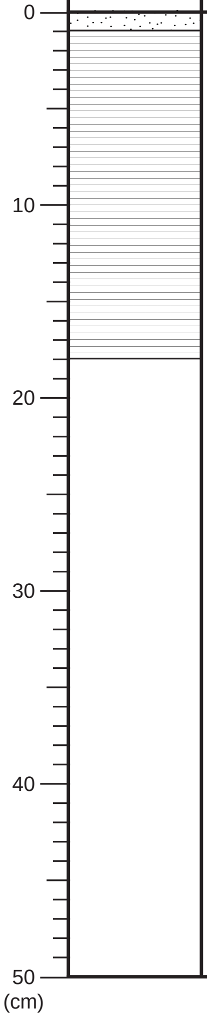
Observer K. Fujioka and K. Hirauchi

Dive #371 Stn. 11, MBARI30cm blue

MBARI Core Sample Description Format

Cruise Number KR06-15
Dive # 372
Date 2006/12/01

Location latitude 18˚ -15.8631'N longitude 147˚ -18.4631'E
Big Blue Seamount
Station 4(MBARI30_ blue)

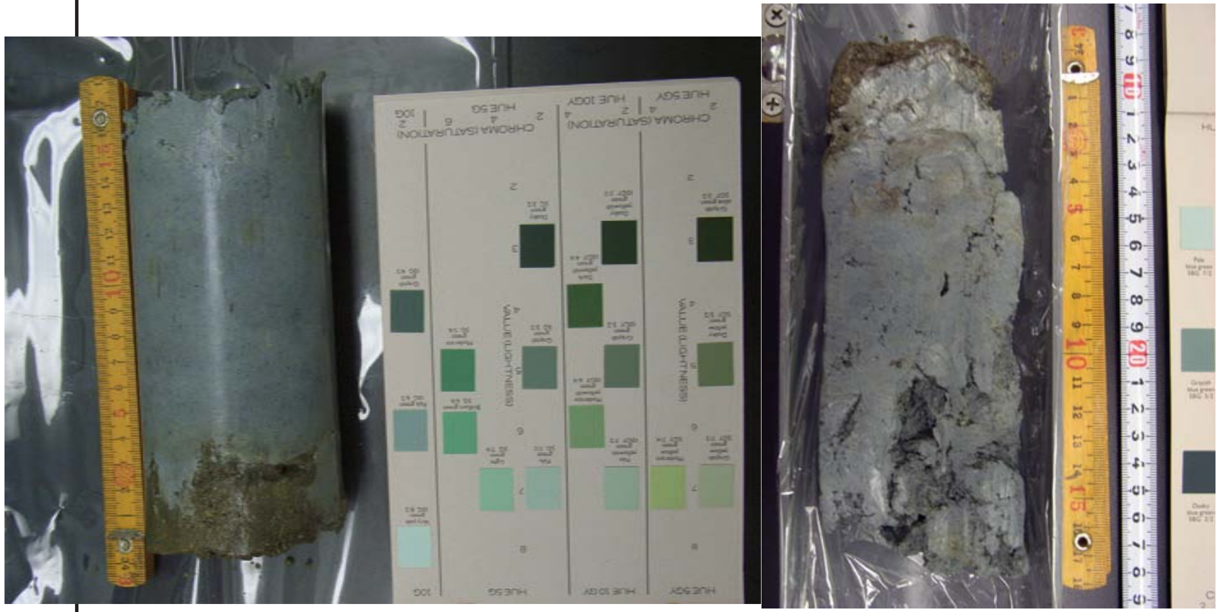


Lithology	Smear Slide	Visual Core Description	Remarks
	☆ 1 cm ☆ 6 cm ☆ 9 cm End of Core 18 cm	a. 0~1 cm 5Y 3/2 Olive gray muddy sand, including black-colored lithic clasts. Foraminifers are scattered in this interval. b. 1~18cm 5BG 7/2 Pale blue green to 5BG 5/2 Grayish blue green sandy mud, derived from almost serpentinite body (serpentine muds). Angular serpentinite clasts are scattered in this interval (1-3 cm in size).	a. Surface 1 cm is oxidized layer. b. Serpentinite fragments in serpentine muds.

Total Core Length 18 cm

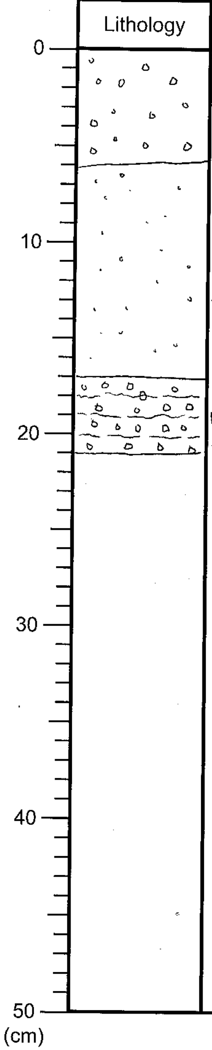
Observer K. Fujioka and K. Hirauchi

Dive #372 Stn. 4, MBARI30cm blue



MBARI Core Sample Description Format

Cruise Number KR06-15	Dive # 373	Date 2006/12/02
Location latitude 17°-53.4400'N longitude 147°-28.5129'E	Unknown 1 Seamount Station 9 (MBARI30 blue)	

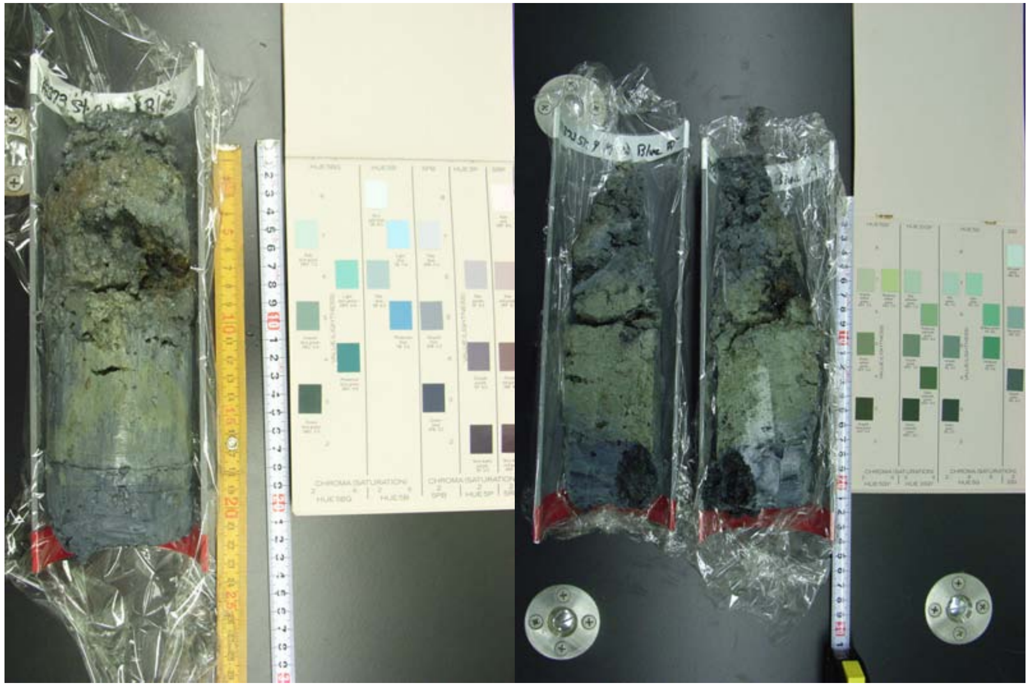


Smear Slide	Visual Core Description	Remarks
☆5cm	0~6cm 5BG 5/2 Grayish blue green to 5BG 3/2 Dusky blue green pebbly muds. Angular black fragments (serpentinite?, ~5mm in size) are scattered within this Interval.	◦ serpentinite-origin pebbles? ◦ Alteration of different color types of mud layers ◦ Network vein (serpentine?) in the lowest section
☆13cm	6~17cm 5GY 7/4 Moderate yellow green to 10GY 6/4 Moderate yellowish green sandy muds, having apparently different color compared to the upper and lower sections.	
☆19cm End of Core 21cm	17~21cm 5BG 5/2 Grayish blue green to 5BG 3/2 Dusty blue green pebbly muds, similar to the uppermost section, but having weakly lamination	

Total Core Length 21 cm

Observer K. Fujioka and K. Hirauchi

Dive #373 Stn. 9, MBARI30cm blue



MBARI Core Sample Description Format

Cruise Number KR06-15

Dive # 373

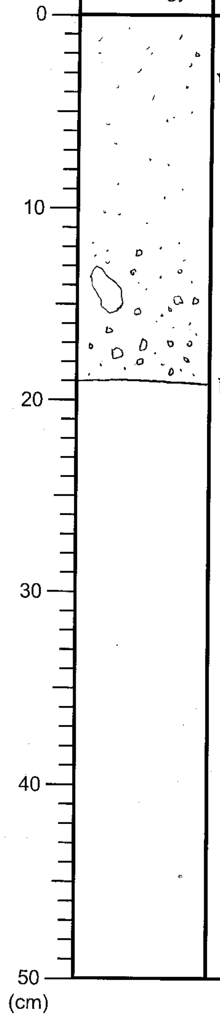
Date 2006/12/02

Location latitude 17°-53.5064'N

longitude 147°-28.4452'N

Unknown 1 Seamount

Station 11 (MBARI50 green)

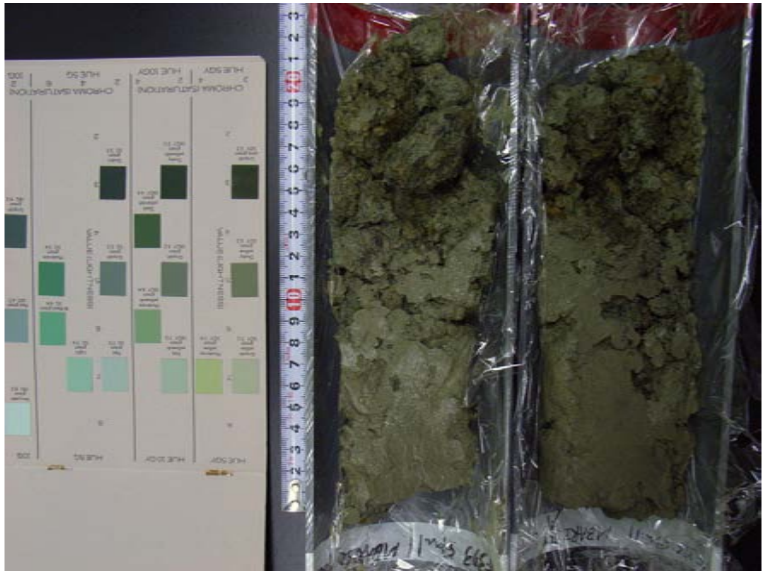


Lithology	Smear Slide	Visual Core Description	Remarks
	☆ 3cm End of Core 19cm	0~20cm 10Y 5/4 light olive to 10Y 4/2 Grayish Olive Sandy muds. Within lower section (13~19cm), Angular black to brown colored fragments are scattered.	∘ serpentinite pebbles? (blacky color, up to about 3cm in size) ∘ Unknown origin fragments (brown color)

Total Core Length 19 cm

Observer K. Fujioka and K. Hirauchi

Dive #373 Stn.11, MBARI50cm green

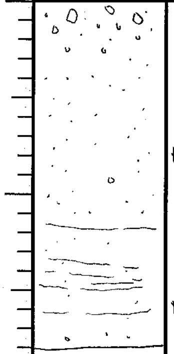


MBARI Core Sample Description Format

Cruise Number KR06-15
Dive # 373
Date 2006/12/02

Location
latitude 17°-53.5498'N
longitude 147°-28.3546'N

Unknown 1 Seamount
Station 13 (MBARI30 black)

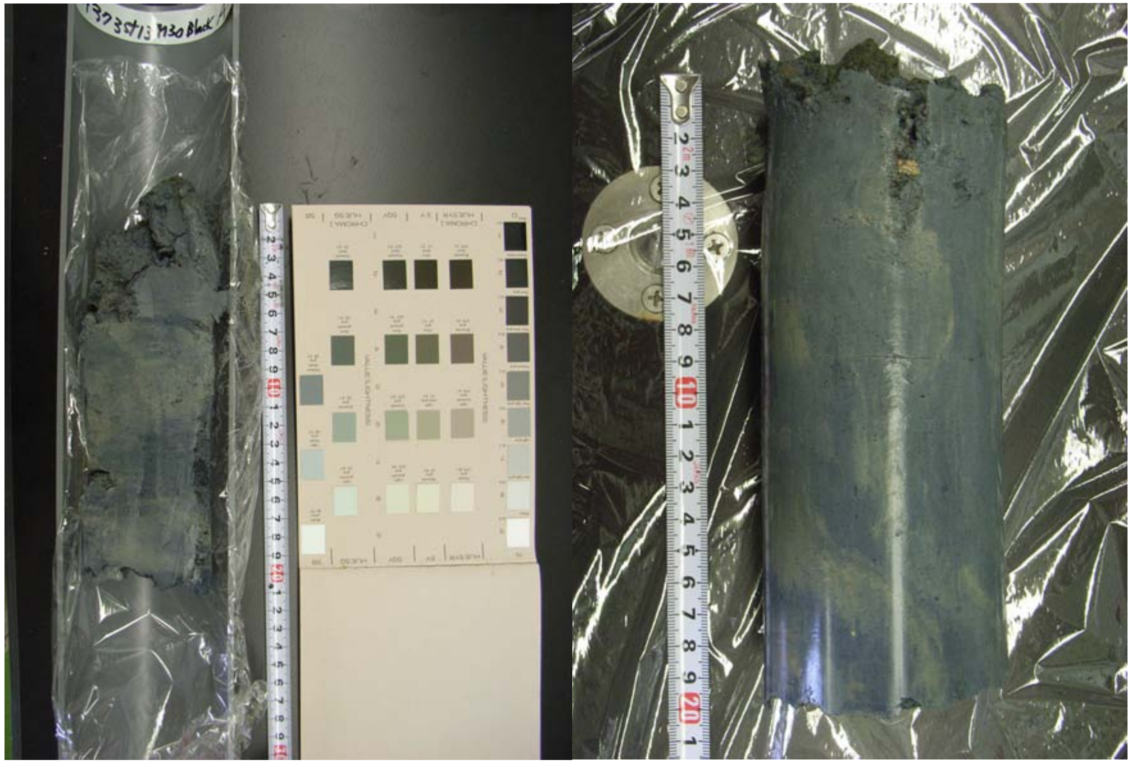
Lithology	Smear Slide	Visual Core Description	Remarks
	☆ 8cm ☆ 16cm	0~18cm 5B 6/2 Pale blue to 5PB 5/2 Grayish blue sandy mud (serpentine muds). In the upper most section (0~4cm), angular fragments having various color are scattered (up to 1.2cm in size). There are parallel lamination particularly in the lower section (evidence for a serpentine flow?) All the section include angular serpentinite fragments (up to 1cm in size).	a. pyrite? (6cm) b. Angular fragments having different types of color c. serpentinite fragments

0
10
20
30
40
50
(cm)

Total Core Length 18 cm

Observer K. Fujioka and K. Hirauchi

Dive #373 Stn. 13, MBARI30cm black



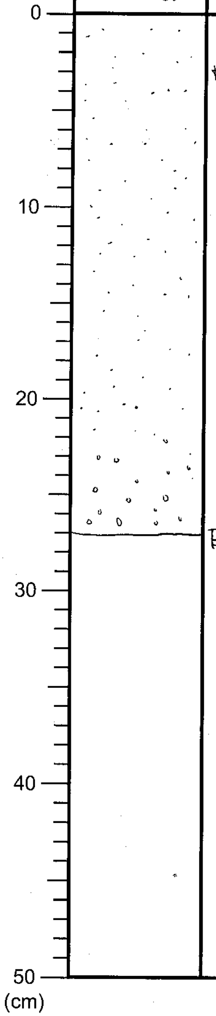
MBARI Core Sample Description Format

Cruise Number KR06-15
Dive # 374
Date 2006/12/03

Location latitude 16°57.4482'N
longitude 147°-10.3912'E

Turquoise Seamount
Station 9 (MBARI30 blue)

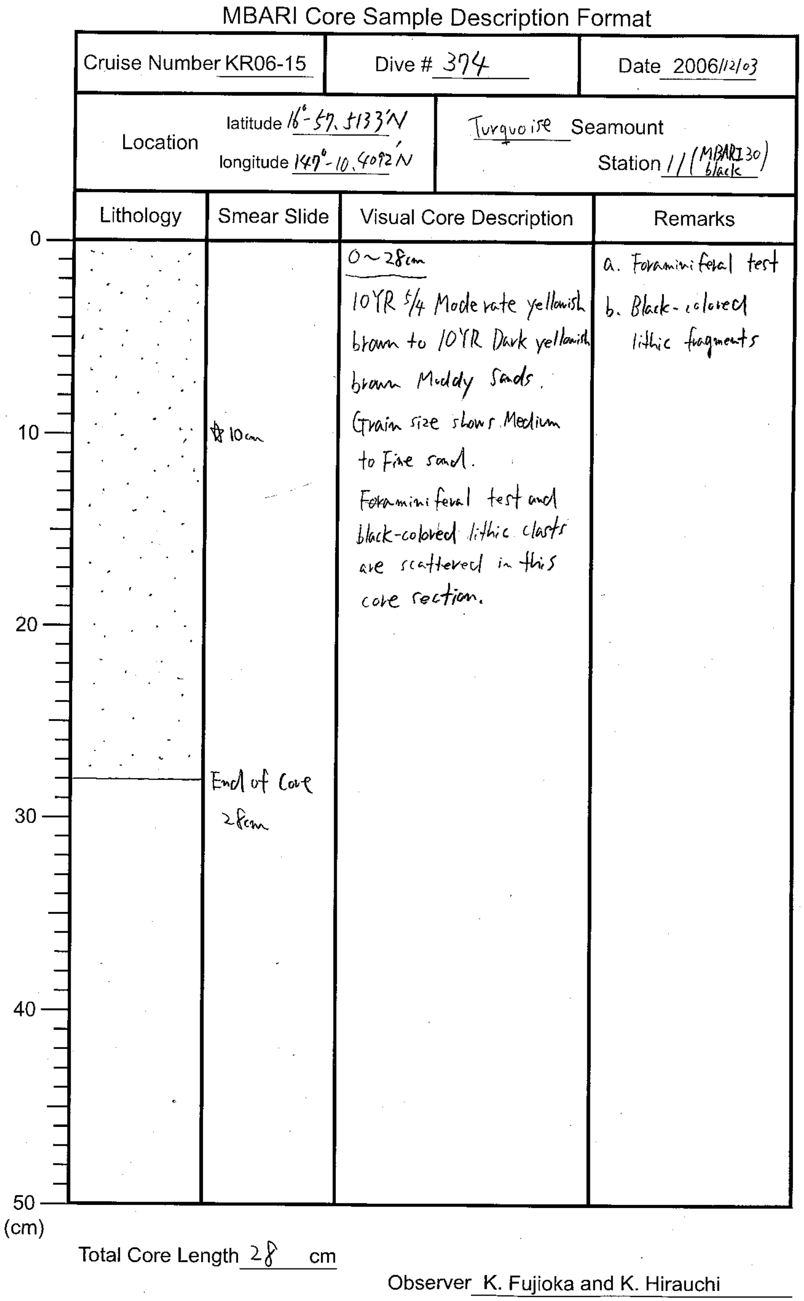
Lithology	Smear Slide	Visual Core Description	Remarks
	☆ 3cm End of Core 27cm	0~27cm 10YR 5/4 Moderate yellowish brown to 10YR 4/2 Dark yellowish brown muddy sand showing weakly fine-grading upward. Foraminferal test and erratic clasts (black color, up to 3mm in size) are scattered in this interval.	a. Foraminiferal test b. Black-colored lithic fragments c. Weakly fine-grading upward (Medium to fine sand)



Total Core Length 27 cm

Observer K. Fujioka and K. Hirauchi

Dive #374 Stn. 9, MBARI30cm blue



MBARI Core Sample Description Format

Cruise Number KR06-15
Dive # 374
Date 2006/12/03

Location
latitude 16°-57.5133'N
longitude 147°-10.4092'N

Turquoise Seamount
Station 11 (MBARI30 black)

Lithology	Smear Slide	Visual Core Description	Remarks
	☆10cm	0~28cm 10YR 5/4 Moderate yellowish brown to 10YR Dark yellowish brown Muddy Sands. Grain size shows Medium to Fine sand. Foraminiferal test and black-colored lithic clasts are scattered in this core section.	a. Foraminiferal test b. Black-colored lithic fragments
	End of Core 28cm		

Total Core Length 28 cm

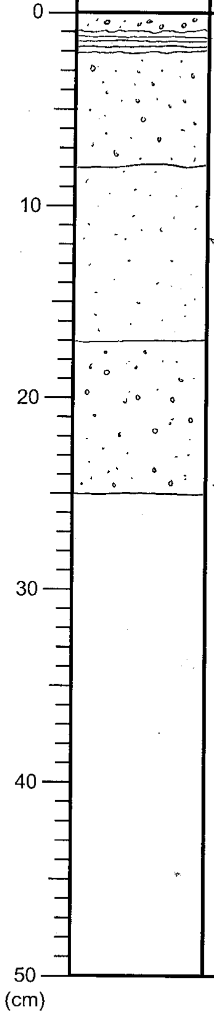
Observer K. Fujioka and K. Hirauchi

Dive #374 Stn.11, MBARI30cm black

MBARI Core Sample Description Format

Cruise Number KR06-15
Dive # 375
Date 2006/12/08

Location latitude 13°-55.4146'N
longitude 146°-14.5486'N
North Chamorro Seamount
Station 1 (MBARI30 blue)

Lithology	Smear Slide	Visual Core Description	Remarks
	☆12cm End of Core 25cm	0~1cm 10YR 6/2 Pale yellowish brown sandy mud, consisting of soft sediments with minor foraminferal tests. 1~2cm 5YR 4/4 Moderate brown to 5YR 3/4 Moderate brown medium sands, including foraminiferl test. 2~8cm 10YR 7/4 Grayish orange to 10YR 5/4 Moderate yellowish brown Sand. Grain size shows medium to coarse sand. Foraminiferal test and black lithic fragments are scattered in this section. 8~17cm 10YR 5/4 Moderate yellowish brown to 10YR 4/2 Dark yellowish brown Sand, similar to the charcteristics of the section in 2~8cm, except for consisting of finer grains. 17~25cm This section has same characteristics of the section of 2~8cm	a. Unknown soft sediments in upper most layer b. Oxidized layer (1~2cm) c. Foraminiferal test

Total Core Length 25 cm

Observer K. Fujioka and K. Hirauchi

Dive #375 Stn.1, MBARI30cm blue

MBARI Core Sample Description Format

Cruise Number KR06-15

Dive # 375

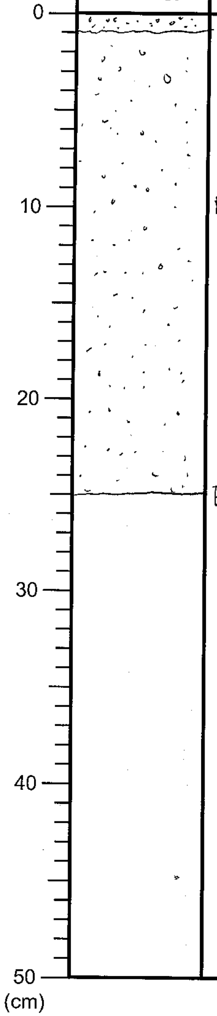
Date 2006/12/08

Location latitude 13° 55. 5794'N

longitude 146°-14. 5278'E

North Chamorro Seamount

Station 3(MBARI30 black)

Lithology	Smear Slide	Visual Core Description	Remarks
	☆ 10cm End of Core 25cm	0~1cm 10YR 6/2 Pale yellowish brown mud, consisting of soft sediments with minor foraminiferal tests. 1~25cm 10YR 7/4 Grayish orange to 10YR 5/4 Moderate yellowish brown massive sand. Foraminiferal test and black lithic clasts are scattered in this interval.	a. Unknown soft sediments b. Foraminiferal test

Total Core Length 25 cm

Observer K. Fujioka and K. Hirauchi

Dive #375 Stn.3, MBARI30cm black

Appendix

KR06-15 Kaiko 7000II Dive DVD

DVD No.	Dive No.	Date	SMT	Camera No.	Start Time	Recording Mode
1	369	Nov. 28, '06	Conical	1	11:48:54	LP
2				2		LP
3				3	11:53:14	LP
4	370	Nov. 29, '06	Pacman	1-1	10:39:16	SP
5				1-2	12:34:26	SP
6				1-3	14:30:36	SP
7				2-1		SP
8				2-2		SP
9				2-3		SP
10				3-1	10:39:23	SP
11				3-2	12:34:38	SP
12				3-3	14:30:49	SP
13	371	Nov. 30.'06	Twin 3	1-1	10:45:25	SP
14				1-2	12:39:04	SP
15				1-3	14:32:39	SP
16				2-1		SP
17				2-2		SP
18				2-3		SP
19				3-1	10:45:41	SP
20				3-2	12:38:26	SP
21				3-3	14:32:54	SP
22	372	Dec. 1, '06	Big Blue	1-1	10:46:14	SP
23				1-2	12:37:55	SP
24				1-3	14:26:10	SP
25				2-1		SP
26				2-2		SP
27				2-3		SP
28				3-1	10:46:11	SP
29				3-2	12:38:04	SP
30				3-3	14:26:30	SP
31	373	Dec. 2, '06	Unknown 1	1-1	12:44:48	SP
32				1-2	12:35:49	SP
33				1-3	14:23:58	SP
34				2-1		SP
35				2-2		SP
36				2-3		SP
37				3-1	12:44:42	SP
38				3-2	12:36:17	SP
39				3-3	14:24:07	SP
40	374	Dec. 3, '06	Turquoise	1-1	10:36:32	SP
41				1-2	12:31:57	SP
42				1-3		SP
43				2-1		SP
44				2-2	10:36:38	SP
45				2-3	12:32:13	SP
46	375	Dec. 8, '06	North Chamorro	1-1	12:22:28	SP
47				1-2	14:15:05	SP
48				1-3		SP
49				2-1		SP
50				2-2	12:22:09	SP
51				2-3	14:14:53	SP

Shipboard Log of KR06-15

Date	Time LCT	Note	Remarks	Position/Weather/Wind/ Sea conditions at noon
24,Nov,06	09:00	Boarding a ship [R/V KAIREI]	Immigration	11/24 12:00(JST)
	09:40	Onboard seminar (-10:30)	For safety KAIREI life	Harbor of JAMSTEC
	14:00	Departure from JAMSTEC		Fine but cloudy
	15:00	Scientific meeting	(-16:00)	NE-4(Moderate breeze)
	16:40	Pray safety cruise to KONPIRASAN	(-17:00)	-
25,Nov,06	09:00	Briefing on [KAIKO 7000II] operation	by ROV operation team (-10:30)	11/25 12:00(JST)
	10:30	Meeting of research dive	(-12:00)	30-04N, 141-54E
	19:00	Scientific meeting (-19:00)	About task sharing during operation	Cloudy
				ENE-7(Near gale)
				5(Sea rough)
				4(Moderate average)
26,Nov,06	00:00	Put shift clock ahead (+ 1 hour)	06/11/26 00:00 -> 06/11/26 01:00	11/26 12:00(JST+1h)
	09:00	On-board science seminar for KAIREI crew	by Dr. Yokose and Dr.Maekawa (-10:00)	25-09N, 144-13E
	19:00	Scientific meeting	(-20:00)	Rain
				ENE-5(Flesh breeze)
				4(Sea moderate)
				4(Moderate average)
27,Nov,06	07:00	Suspended today's dive for rough sea		11/27 12:00(JST+1h)
	08:00	Meeting for geophysical survey planning	(-09:00)	19-33N, 146-39E
	11:21	Arrived at research area		Fine but cloudy
		Release XBT sensor and measurement	19-39.7718N, 146-35.3001E	East-5(Flesh breeze)
		Actuation check of KICS system		3(Sea slight)
	13:05	Deploy proton magnetometer		4(Moderate average)
	13:36	Commenced figure eight turn	(-13:47)	
	14:13	Commenced MBES mapping survey		
	19:00	Scientific meeting	(-20:00)	
		Presentation of relationship with eel and Mariana trough by Dr.Yokose, Kumamoto University		
28,Nov,06	02:41	Finished MBES mapping survey		11/28 12:00(JST+1h)
	07:00	Arrived at dive point	Conical Seamount	19-32N, 146-39E
	10:15	7K hoisted up		Fine but cloudy
	10:21	7K launched, and dive started 7K#369		East-4(Moderate breeze)
	11:49	Separated Launcher and vehicle	Depth 3085m	3(Sea slight)
	12:04	Vehicle landed on bottom	Depth 3209m	3(Moderate short)
	14:40	Vehicle left the bottom	Depth 3121m	Visibility: 12'
	14:50	Combined Launcher and vehicle		
	15:57	7K hoisted up		
	16:07	Finished 7K operation		
	16:58	Deploy proton magnetometer		
	19:00	Scientific meeting	till 20:00	
	19:34	Resumed MBES mapping survey		
29,Nov,06	04:30	Finished MBES mapping survey		11/29 12:00(JST+1h)
	07:04	Recovered proton magnetometer		19-16N, 146-56E
	09:05	7K hoisted up		Fine but cloudy
	09:12	7K launched, and dive started 7K#370	Pacman Seamount	East-5(Fresh breeze)
	10:37	Separated Launcher and vehicle		4(Sea moderate)
	10:48	Vehicle landed on bottom	Depth 3143m	3(Moderate short)
	14:52	Vehicle left the bottom	Depth 3036m	Visibility: 12'
	15:02	Combined Launcher and vehicle		
	16:06	7K hoisted up		
	16:15	Finished 7K operation		
	17:04	Deploy proton magnetometer		
	18:33	Resumed MBES mapping survey		
	19:00	Scientific meeting	till 20:00	
30,Nov,06	04:30	Finished MBES mapping survey		11/30 12:00(JST+1h)
	07:00	Recovered proton magnetometer		18-36N, 146-59E
	07:06	Release XBT sensor and measurement	18-35.9N, 146-58.0E	Fine but cloudy
	09:08	7K hoisted up	Serpentinite seamount of westward slope	East-6(Strong breeze)
	09:14	7K launched, and dive started 7K#371	(Twin Peaks 3 ;tentatively)	4(Sea moderate)
	10:36	Separated Launcher and vehicle		4(Moderate average)
	10:50	Vehicle landed on bottom	Depth 2948m	Visibility: 12'
	14:43	Vehicle left the bottom	Depth 2632m	
	14:56	Combined Launcher and vehicle		
	15:54	7K hoisted up		
	16:04	Finished 7K operation		
	16:51	Deploy proton magnetometer		
	19:00	Scientific meeting	till 19:30	
	19:28	Resumed MBES mapping survey		
	22:05	Finished survey line No.1 around Unknown Seamount.		
		Discussion on this area and decision of tomorrow's dive site.		

Date	Time LCT	Note	Remarks	Position/Weather/Wind/ Sea conditions at noon
01,Dec,06	04:00	Finished MBES mapping survey		12/01 12:00(JST+1h)
	07:01	Recovered proton magnetometer		18-16N, 147-18E
	09:00	7K hoisted up		Fine but cloudy
	09:04	7K launched, and dive started 7K#372	Big Blue Seamount	East-5(Fresh breeze)
	10:35	Separated Launcher and vehicle		4(Sea moderate)
	10:50	Vehicle landed on bottom	Depth 3498m	4(Moderate average)
	14:38	Vehicle left the bottom	Depth 3055m	Visibility: 12'
	14:52	Combined Launcher and vehicle		
	15:56	7K hoisted up		
	16:07	Finished 7K operation		
	16:54	Deploy proton magnetometer		
	18:53	Resumed MBES mapping survey		
	19:00	Scientific meeting	till 19:40	
02,Dec,06	06:00	Finished MBES mapping survey		12/02 12:00(JST+1h)
	07:00	Recovered proton magnetometer		17-53N, 147-29E
	08:55	7K hoisted up		Fine but cloudy
	09:02	7K launched, and dive started 7K#373	Serpentinite seamount of westward slope	East-3(Gentle breeze)
	10:36	Separated Launcher and vehicle	(Unknown 3 ;tentatively)	4(Sea moderate)
	10:48	Vehicle landed on bottom	Depth 3736m	4(Moderate average)
	14:36	Vehicle left the bottom	Depth 3305m	Visibility: 12'
	14:49	Combined Launcher and vehicle		
	15:56	7K hoisted up		
	16:04	Finished 7K operation		
	17:00	Deploy proton magnetometer		
	18:21	Resumed MBES mapping survey		
	19:00	Scientific meeting	till 19:40	
03,Dec,06	05:05	Finished MBES mapping survey		12/03 12:00(JST+1h)
	06:59	Release XBT sensor and measurement	16-56.903N, 147-10.0988E	16-57N, 147-10E
	07:00	Recovered proton magnetometer		Fine but cloudy
	08:51	7K hoisted up		East-6(Strong breeze)
	08:58	7K launched, and dive started 7K#374	Turquoise Seamount	4(Sea moderate)
	10:25	Separated Launcher and vehicle		4(Moderate average)
	10:41	Vehicle landed on bottom	Depth 3306m	Visibility: 12'
	13:41	Vehicle left the bottom	Depth 3196m	
	13:52	Combined Launcher and vehicle		
	14:56	7K hoisted up		
	15:06	Finished 7K operation		
	15:51	Deploy proton magnetometer		
	19:00	Resumed MBES mapping survey		
	19:00	Scientific meeting		
		Presentation about development history of [KAIKO 7000II] by Mr. Nakajyo (JAMSTEC)		
04,Dec,06	04:05	Finished MBES mapping survey		12/04 12:00(JST+1h)
	07:00	Recovered proton magnetometer		16-13N, 147-27E
	08:20	Suspended today's dive for rough sea		Fine but cloudy
	08:30	Deploy proton magnetometer		East-6(Strong breeze)
	09:55	Resumed MBES mapping survey		5(Sea rough)
	13:00	Excursion to the engine room	(-13:30)	4(Moderate average)
	19:00	Scientific meeting		Visibility: 12'
		Presentation about serpentinization of Franciscan Complex, Monterey by Mr. Hirauchi, Tsukuba University		
05,Dec,06	02:50	Finished MBES mapping survey		12/05 12:00(JST+1h)
	08:30	Suspended today's dive for rough sea		16-28N, 147-32E
	09:51	Recovered proton magnetometer		Cloudy
	11:15	Resumed MBES mapping survey		NE-7(Near gale)
	12:22	Suspended MBES survey for rough sea		6(Very rough)
	12:30	Shift to Peacock Seamount by slow degree		4(Moderate average)
	19:00	Scientific meeting	(-20:15)	Visibility: 7'
		Presentation about experience of Kenya by Dr. Yamamoto, Nagoya University		

Date	Time LCT	Note	Remarks	Position/Weather/Wind/ Sea conditions at noon
06,Dec,06	08:30	Suspended today's dive for rough sea		12/06 12:00(JST+1h)
	12:32	Resumed MBES mapping survey	to North Chamorro Seamount	15-48N, 147-28E
	19:00	Scientific meeting	(-19:45)	Fine but cloudy
		Presentation about pore water chemistry related to serpentinite by Dr. Chiba, Okayama University		
				ENE-6(Strong breeze)
				5(Sea rough)
				4(Moderate average)
				Visibility: 10'
07,Dec,06	05:29	Finished MBES mapping survey		12/07 12:00(JST+1h)
	08:30	Suspended today's dive for rough sea		14-10N, 146-08E
	10:24	Resumed MBES mapping survey		Cloudy
	11:01	Finished MBES for rough sea		ENE-7(Near gale)
	19:00	Scientific meeting		5(Sea rough)
		Presentation about significance of serpentinite and associated metasomatic rocks by Dr. Maekawa		
				4(Moderate average)
		Is Mariana serpentine seamount result of huge slope sliding? By Dr. Fujioka.		Visibility: 6'
08,Dec,06	10:37	7K hoisted up		12/08 12:00(JST+1h)
	10:43	7K launched, and dive started 7K#375	North Chamorro Seamount	13-55N, 146-15E
	12:12	Separated Launcher and vehicle		Fine but cloudy
	12:27	Vehicle landed on bottom	Depth 3484m	NE-5(Fresh breeze)
	14:44	Vehicle left the bottom	Depth 3449m	4(Sea moderate)
	14:56	Combined Launcher and vehicle		4(Moderate average)
	16:12	7K hoisted up		Visibility: 10'
	16:21	Finished 7K operation		
	17:00	Commenced proceeding to challenger deep area		
	19:00	Scientific meeting		
		(Leg.1compleated, last hurrah!!)		
09,Dec,06				12/09 12:00(JST+1h)
				11-21N, 142-26E
				Fine but cloudy
				N-4(Moderate breeze)
				2(Sea smooth)
				3(Moderate short)
				Visibility: 12'
10,Dec,06				12/10 12:00(JST+1h)
				11-24N, 142-34E
				Fine but cloudy
				SSE-3(Gentle breeze)
				2(Sea smooth)
				3(Moderate short)
				Visibility: 12'
11,Dec,06				12/11 12:00(JST+1h)
				11-21N, 142-25E
				Fine but cloudy
	10:30	Commenced proceeding to GUAM		ENE-4(Moderate breeze)
				3(Sea slight)
				3(Moderate short)
				Visibility: 12'
12,Dec,06	09:00	Arrived at GUAM/Apra Habor		
		Compleat the KR0-15 cruise		

KR06-15 Ship track