Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-01 Room:101B Time:May 24 09:00-09:24

Digest of first part of IODP NanTro SEIZE project

SAKAGUCHI, Arito[1*], KINOSHITA, Masataka[1]

[1]JAMSTEC

The IODP Nankai trough seismogenic zone drilling project (NanTro SEIZE) aims to understand the earthquake mechanics from fault rock analysis, borehole logging and long term monitoring. This project has been doing since 2007, and deep riser drilling to reach seismogenic depth will start on 2012. We introduce three topics of (1) Identification of earthquake fault of 1944 Tonankai, (2) In-situ stress at seismogenic area and (3) Seismic rupture propagation to the unexpected shallow portion.

Two major thrusts of plate boundary and mega-splay faults are developed off Kumano area. It was hard to know earthquake history of abyssal plate subduction faults. Strong seismic shaking originated mud-breccia was found around mega-splay fault. The 210Pb method revealed that the formation of latest mud-breccia is concordant with the 1944 Tonankai earthquake (Sakaguchi et al., 2011). This is a direct evidence of the earthquake fault as 1944 Tonankai earthquake.

Stress distribution across the Tonankai earthquake are was revealed using the technique of Borehole breakout, Borehole hydrofracturing test and Anelastic strain recovery. In the result, most of area affects compression stress concordant with pate convergent direction except the area of hanging wall of the mega-splay fault. Though this is still controversy, local stress difference may be due to thrust related hanging wall deformation and/or is limited in shallow portion (Byrne, et al 2009).

The geothermometric analysis of the fault core sample reveals that the two examined fault zones underwent localized high temperature though the toe of the accretionary wedge has classically been considered aseismic zone.. This suggests that coseismic slip must have propagated to the up-dip end of the megasplay fault and to the toe of the accretionary wedge (Sakaguchi, et al., 2011).

Keywords: Nankai, Seismogenic, Plate subduction, Fault

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-02 Room:101B Time:May 24 09:42-09:57

Hydrate content estimated from Chlorinity and insitu temperature anomalies at IODP Site C0008

KINOSHITA, Masataka[1*], Fukase, Hiroaki[2]

[1]JASMTEC, [2]Kochi Univ.

During the IODP Expedition 316 (NanTroSEIZE Stage 1) in 2007, significant negative anomalies in the pore fluid chlorinity were reported from the core samples taken 100m below the seafloor at IODP Site C0008 in the slope sediment seaward of the mega-splay fault zone. We estimated the total contents of methane hydrate from this Cl anomaly and the porosity measured for core samples. The maximum content percentage is 40% at a horizon with strong reflectivity, suggesting a sandy interval.

In the vicinity of Cl anomaly interval, we discovered a negative temperature anomaly of up to 1K, measured insitu using the APC-T tool attached to the shoe of the hydraulic piston corer. Although our preferred interpretation for this negative excursions is a dissociation of hydrate at the time of coring, the amount of dissolved hydrates estimated from the latent heat of fusion is only at most 2% (total content). This may be due to the localized distribution of hydrate.

We will propose a hypothetical model that the methane gas was originally formed beneath the base of hydrate stability when the mega-splay fault uplifted, and was transferred to Site C0008 through the fault zone and the sandy horizon.

Keywords: NanTroSEIZE, methane hydrate, splay fault, submarine landslide

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-03 Room:101B Time:May 24 09:57-10:12

Deep Fault Drilling Project -Alpine Fault

FUKUDA, Jun-ichi[1*], HIRONO, Tetsuro[2], OKUDAIRA, Takamoto[3], ISHIKAWA, Tsuyoshi[4], SATO, Hiroshi[5], Rupert Sutherland[6], John Townend[7], Virginia Toy[8]

[1]Department of Earth Sciences, Graduate School of Science, Tohoku University, [2]Department of Earth and Space Science, Graduate School of Science, Osaka University, [3]Department of Geosciences, Graduate School of Science, Osaka City University, [4]Kochi Institute for Core Sample Research, Japan Agency for Marine-Earth Science and Technology, [5]Earthquake Prediction Research Center, Earthquake Research Institute, The University, [6]GNS Science, [7]Victoria University, [8]University of Otago

The Alpine Fault (South Island, New Zealand) is one of the largest active fault zones on earth. It ruptures every 200-400 years in a magnitude ˜7.9 earthquake, and is thought to have last ruptured in AD 1717, which implies a significant geohazard potential. For understanding the seismogenesis and the habitat of earthquakes, ductile and brittle deformation mechanisms and their interaction, and evolution of a transpressive orogenic system, the ”Deep Fault Drilling Project - Alpine Fault (DFDP-AF) was started from January 2011. The first, phase (DFDP-1), which targeted to drill to 150 m, has completed on February 2011, and the samples have already been provided to international scientific community. DFDP-2 is planed to drill to 1500 m through the Alpine Fault as one of the International Continental Scientific Drilling Program (ICDP), and is now working. In this presentation, we outline this drilling project.

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-04 Room:101B Time:May 24 10:15-10:30

Consolidated nano-polycrytalline diamond and its potential applications to deep-Earth drilling

IRIFUNE, Tetsuo[1*]

[1]Geodynamics Research Center, Ehime University

We have been developping technology to synthesize ultrahard nano-polycrystalline diamond (NPD = HIME-DIAMOND), using multianvil high-pressure technology. Now, we are able to make such NPD rods with dimensions of up to 1 cm in both diameter and length on a routine basis. NPD is known to have exceptional hardness and toughness, which withstands even high temperatures exceeding 1300K. Here, I will report current status of the synthesis, properties, and some applications of NPD. NPD should also be potentially important as a drilling tool, because of its ultrahardness and high toughness at high temperature, which are far superior to those of conventional hard materials such as tunguten carbide or sintered polycrystalline diamond with some binders.

Keywords: ultarahard material, diamond, polycrystalline material, deep Earth drilling, mantle, high pressure

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-05 Room:101B Time:May 24 10:45-11:00

Stress and strain analyses in the Costa Rica subduction margin, IODP Expedition 334

YAMAMOTO, Yuzuru[1*], LIN, Weiren[1], USUI, Yoichi[1], KANAMATSU, Toshiya[1], SAITO, Saneatsu[1], Xixi Zhao[2], HASHIMOTO, Yoshitaka[3], Michael Stipp[4], UJIIE, Kohtaro[5], Paola Vannucchi[6]

[1]IFREE, JAMSTEC, [2]University of California, Santa Cruz, [3]Kochi University, [4]IFM-GEOMAR, [5]University of Tsukuba, [6]University of Florence

The Costa Rica Seismogenesis Project (CRISP) is designed to understand the processes that control nucleation and seismic rupture of large earthquakes at erosional subduction zones. Integrated Ocean Drilling Program (IODP) Expedition 334 drilled and cored at the middle slope (Sites U1378 and U1380), upper slope (Site U1379), and input site (Site U1381).

Stress and strain analyses using anelastic strain recovery (ASR), fault kinematics, and anisotropy of magnetic susceptibility (AMS) have been conducted in the middle and the upper slope. Based on ASR analyses, clear difference in present-days stress state between the slope sediments and the basement was identified in the Site U1379: A normal-fault stress regime characterizes the slope sediments, whereas a strike-slip regime corresponds to the basement. On the other hand, the stress-states in the slope sediments in the Sites U1378 and U1380 are characterized by a strike-slip regime that Sigma 2 has oriented vertically. The Sigma 1 direction oriented NNW-SSE, which is corresponding to the Sigma Hmax direction identified in the LWD, parallel to the present GPS direction. In contrast to the present-day stress state, the ancient stress and strain based on kinematics of faults and AMS were controlled by direction of plate subduction. The spatial and time variations in stress state along the CRISP transect is a key to examining the onset of subduction erosion along the subduction channel.

Keywords: Subduction erosion, ASR, AMS, CRISP, Expedition 334, IODP

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-06 Room:101B Time:May 24 11:00-11:15

Limited Mantle Plume Motion for the Louisville Hotspot

KOPPERS, Anthony[1], YAMAZAKI, Toshitsugu[2*], GELDMACHER, Joerg[3], Jeffrey S. Gee[4], Nicola Pressling[5], HOSHI, Hiroyuki[6], the IODP Expedition 330 Scientific Party[7]

[1]Oregon State University, [2]Geological Survey of Japan, AIST, [3]GEOMAR, [4]Scripps Institution of Oceanography, UCSD, [5]University of Southampton, [6]Aichi University of Education, [7]n/a

Deep Earth convection can be understood by studying hotspot volcanoes that form where mantle plumes rise up and intersect the lithosphere, the Earth's rigid outer layer. For many years it has been widely assumed that these narrow diapirs generate stationary hotspots within an overall convective mantle regime, but it is apparent now that the Hawaiian mantle plume moved approximately 15 degrees south between about 80 and 50 million years ago. In this presentation we show that the Louisville hotspot in the South Pacific behaved in a different way over the same time period, experiencing only a limited latitudinal motion, using drill cores of Integrated Ocean Drilling Program Expedition 330. Our findings demonstrate that the motions of the Louisville and Hawaiian hotspots are incompatible and that mantle plumes are moving independently.

Keywords: hotspot, plume motion, seamount, paleolatitude, paleomagnetism, IODP

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-07 Room:101B Time:May 24 11:15-11:30

Petrographical and geochemical characteristics of the sheeted dyke-gabbro transition zone in ODP/IODP Hole 1256D

PYTHON, Marie[1*], Lyderic France[2], Benedicte Abily[3], ABE, Natsue[4], Jeff C. Alt[5], Marguerite M. Godard[6], Benoit Ildefonse[6], Jurgen H. Koepke[7], Mark D. Kurtz[8], Ryo Oizumi[9], PAYOT, Betchaida[10], The Exp. 335 Science Party[11]

[1]Hokkaido University, Department of Natural History Sciences, Sappro, Japan, [2]CNRS-UPR 9046, Centre de Recherches Petrographiques et Geochimiques, Nancy, France, [3]Observatoire Midi-Pyrenees, Laboratoire Geosciences Environnement Toulouse, Toulouse, France, [4]Japan Agency for Marine-Earth Science and Technology, Deep Sea Research Department, Yokosuka, Japan, [5]University of Michigan, Department of Geological Sciences, Ann Arbor, USA, [6]CNRS-Universite Montpellier II, Geosciences Montpellier, Montpellier, France, [7]University of Hannover, Institut fuer Mineralogie, Hannover, Germany, [8]Woods Hole Oceanographic Institution, Department of Marine Chemistry and Geochemistry, Woods Hole, U, [9]Yamagata University, Department of Earth Sciences, Yamagata, Japan, [10]Kanazawa University, Department of Earth Sciences, Kanazawa, Japan, [11]IODP, Texas A&M University, College Station, USA

During IODP Expedition 335, high grade granoblastic hornfels were extensively recovered as drilling cuttings at the gabbro-sheeted dyke transition zone of ODP Hole 1256D (East Pacific Rise, 6^o44.163'N, 91^o56.061'W). This lithology probably results from high-temperature metamorphism of previously hydrothermally altered diabases and/or basalts; the heat source likely stems from the melt lens located at the top of the magmatic chambers imaged along present-day fast-spreading ridges. This lithology, associated with gabbroic bodies, characterises the transition zone between the sheeted dyke complex and the uppermost gabbroic section and represents the interface between magmatic and hydrothermal convecting systems in an oceanic crust formed at fast-spreading ridges. In this study, 14 samples from the junk basket (cuttings) and 2 samples from cores obtained during Expedition 335 were observed and analysed. The petrological and chemical characteristics of 5 granoblastic samples collected during Expedition 312 at the root of the sheeted dyke complex and between two gabbroic horizons were also acquired for comparison.

Samples collected during IODP Expedition 335 are mainly fine grained oxide grabbronorites composed of two pyroxenes, plagioclases and oxides (ilmenite, magnetite) with more or less amphiboles, sulphides, quartz and accessory minerals. Orthopyroxene Shape (roundish or anhedral), the amount of oxides inclusions in clinopyroxene and plagioclase morphology (laths or triple-junction mosaic) indicate various recrystallisation degrees. Plagioclases show a strong zoning in the less recrystallised samples, which tend to disappear with increasing recrystallisation degree. Samples show usually low alteration (less than 10%) with moderate transformation of pyroxenes into talc or actinolite. Samples from Expedition 312 show finer grains, higher degree of alteration (up to 30%), and weaker recrystallisation. They are mainly composed of plagioclases, amphibole and oxides (ilmenite, magnetite) with more or less pyroxenes, quartz and alteration phases. Samples from the higher stratigraphic level (root of the sheeted dyke complex above the shallowest gabbro) are virtually free of pyroxenes while the strongly recrystallised samples from the bottom of the hole (i.e. closer to the gabbroic section) contain only episodic amphibole and are rich in pyroxenes. The composition of plagioclase ranges from An_{12} to An_{85}, with higher anorthite contents observed in the most recrystallised samples. Pyroxenes composition ranges from $Wo_{37}En_{46}Fs_{17}$ to $Wo_{46}En_{38}Fs_{16}$ for Cpx and $Wo_4En_{59}Fs_{37}$ to $Wo_2En_{65}Fs_{33}$ for Opx, and does not show any significant variation with the recrystallisation degree. Temperatures of recrystallisation were estimated between 902 and 980^{o}C using the two-pyroxenes geothermometer.

Heating and probable partial melting resulting from magmatic activity below hydrothermally altered sheeted dyke complex would lead to metamorphism and recrystallisation associated with light elements migration resulting in variations in the modal composition of the rock and in the chemical composition of the minerals stable in hydrothermal and magmatic conditions.

Keywords: ODP/IODP Hole 1256D, Beerbachites, Granoblastic dykes, Fast-spreading ridge, East pacific Rise, IODP Exp. 335

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-08 Room:101B Time:May 24 11:30-11:45

Origin and distribution of chloride in pore water beneath the New Jersey Shallow Shelf, IODP Exp.313

HAYASHI, Takeshi[1*], OTSUKA, Hironori[2], ANDO, Hisao[3]

[1]Akita University, [2]Atmosphere and Ocean Research Iinstitute,The University of Tokyo, [3]The College of Science, Ibaraki University

IODP Exp. 313 was conducted in the mid New Jersey Shallow Shelf (NJSS) in 2009. This expedition focuses on geological structure and history of sedimentological environment with sea level change. Three holes were drilled along the MAT (Mid-Atlantic Transect) and the maximum depth was 750 mbsf.

On the other hand, in the NJSS, previous expeditions and oil explorations have found that the pore water beneath sea floor has very wide range of chloride concentration. This variation of Cl concentration is considered to reflect the history of salinization and desalinization of pore water with sea level change. However, process and mechanism of Cl distribution is not clarified. Objective of this study is to understand origin and behavior of pore water and chloride using pore water samples taken by Exp. 313.

Cl concentration of pore water samples were from about 20 to 995 mmol/kg (4 to 190% of seawater). ”Fresh” pore water (Cl $<$ 100 mmol/kg) were distributed from about 15 to 420 mbsf and were mainly in silty layers. This result suggests that pore water in low permeable layers such as silt and clay were relatively not susceptible to salinization by seawater.

Considering the stable isotopic ratios of oxygen and hydrogen and Cl concentration of pore water, origins of pore water should be meteoric water, present sea water and paleo sea water. Also, origins of chloride were considered to be present and paleo sea water and brine. From the sea floor to 250˜350mbsf, chloride in pore water was originated from mixing of the meteoric water and present/paleo sea water. On the contrary, chloride was originated from mixing of the meteoric water and brine.

This study is supported by CDEX/JAMSTEC.

Keywords: IODP, New Jersey, continental shelf, sea level change, pore water, chloride

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-09 Room:101B Time:May 24 11:45-12:00

Onset, evolution and effects of the Mediterranean Outflow: An overview of IODP Expedition 339

KURODA, Junichiro[1*], HERNANDEZ-MOLINA, F. Javier[2], STOW, Dorrik[3], ALVAREZ-ZARIKIAN, Carlos[4], JIMENEZ-ESPEJO, Francisco J.[5], FUROTA, Satoshi[6], NANAYAMA, Futoshi[7], NISHIDA, Naohisa[7], TAKASHIMIZU, Yasuhiro[8], Expedition IODP 339 Scientists#[4]

[1]Japan Agency for Marine-Earth Science and Technology, [2]Departmento Geociencias Marinas, Universidad de Vigo, Facultad de Ciencias del Mar, [3]Institute of Petroleum Engineering, Heriot-Watt University, [4]Integrated Ocean Drilling Program, Texas A&M University, [5]Instituto Andaluz de Ciencias de la Tierra, Universidad de Granada, [6]Earth and Planetary System Science, Department of Natural History Science, Graduate School of Scienc, [7]The Gological Survey of Japan, AIST, [8]Mathematical and Natural Sciences, Niigata University

We will present the preliminary results of IODP Expedition 339, Mediterranean Outflow (from 17 November 2011 to 17 January 2012). This expedition has drilled five sites in the Gulf of Cadiz and two sites offshore the west Iberian margin, and recovered 5.5 km of core with an average recovery of 86.4%. The Gulf of Cadiz was targeted for drilling as a key location for the investigation of Mediterranean Outflow Water (MOW) through the Straits of Gibraltar and its influence on global circulation and climate. It is also a prime area for understanding the effects of tectonic activity on evolution of the Gibraltar Gateway and on margin sedimentation.

We penetrated into the Miocene at two different sites and established a strong signal of MOW in the sedimentary record of the Gulf of Cadiz following opening of the Gibraltar Gateway. Preliminary results show contourite deposition from 4.2-4.5 Ma, although subsequent research will establish whether this dates from the first onset of MOW. The Pliocene succession, penetrated at four sites, shows low bottom current activity linked with a weak MOW. Significant widespread unconformities, present in all sites but with hiatuses of variable duration, are interpreted as a signal of intensified MOW, coupled with flow confinement. The Quaternary succession shows a much more pronounced phase of contourite drift development, with two periods of MOW intensification separated by a widespread unconformity. Following this, the final phase of drift evolution established the contourite depositional system (CDS) architecture we see today.

There is a significant climate control on this evolution of MOW and bottom-current activity. However, from the closure of the Atlantic-Mediterranean gateways in Spain and Morocco just over 6 Ma and the opening of the Gibraltar Gateway at 5.3 Ma, there has been an even stronger tectonic control on margin development, downslope sediment transport and contourite drift evolution. Based on the timing of events recorded in the sedimentary record, we propose a tectonic pulsing in the region, linked with asthenosphere activity.

The Gulf of Cadiz is the world's premier contourite laboratory and thus presented an ideal testing ground for the contourite paradigm. Following examination of over 4.5 km of contourite cores, the existing models for contourite deposition are found to be in good working order. Their further study will allow us to resolve outstanding issues of depositional processes, drift budgets, and recognition of fossil contourites in the ancient record onshore. The expedition also verified an enormous quantity and extensive distribution of contourite sands that are clean and well sorted. These represent a completely new and important exploration target for potential oil and gas reservoirs. Preliminary work has shown a remarkable record of orbital-scale variation in bulk sediment properties of contourites at several of the drift sites and a good correlation between all sites. The climate control on contourite sedimentation is clearly significant at this scale; further work will determine the nature of controls at the millennial scale.

#IODP Expedition 339 Scientists: Acton, G., Bahr, A., Balestra, B., Ducassou. E., Flood, R., Flores, J-A., Grunert, P., Hodell, D., Kim, J. K., Krissek, L., Li, B., Llave, E., Lofi, J., Lourens, L., Miller, M., Richter, C., Roque, C., Sanchez Goni, M., Sierro Sanchez, F., Singh, A., Sloss, C., Tzanova, A., Voelker, A., Williams, T., Xuan, C.

Keywords: IODP Expedition 339, Gulf of Cadiz, Mediterranean Outflow Water

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-10 Room:101B Time:May 24 13:45-14:00

Radiolarian biostratigraphy from the early Eocene to early Miocene at IODP Leg 320, Sites U1331, U1332, and U1333

KAMIKURI, Shin-ichi[1*]

[1]Kochi University

Early Eocene-early Miocene 228 radiolarian datum events are identified and correlated with the geochronologic time scale at Sites U1331, U1332, and U1333 in the equatorial Pacific Ocean. Seven new Oligocene subzones are proposed for the low latitude radiolarian zonal scheme: Eucyrtidium diaphanes Interval Subzone (RP22b); Calocycletta robusta Interval Subzone (RP22a); Lychnocanoma apodora Interval Subzone (RP21b); Theocyrtis annosa Interval Subzone (RP21a); Eucyrtidium plesiodiaphanes Interval Subzone (RP20c); Dorcadospyris pseudopapilio Interval Subzone (RP20b); Lithocyclia angusta Interval Subzone (RP20a). These subdivisions materially improve the biostratigraphic/biochronologic resolution within the relatively short zone/subzone (~1.6 my). The Oligocene zonal boundary events are synchronous in the low latitude Pacific Ocean based on new data and previous literature. Four Eocene zones, Cryptocarpium ornatum (RP19), Calocyclas bandyca (RP18), Phormocyrtis striata striata (RP9), and Buryella clinata (RP8) are emended.

Keywords: equatorial Pacific, eEocene, EOligocene, radiolarian biostratigraphy, IODP, PEAT I

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-11 Room:101B Time:May 24 14:00-14:15

Variations in SST and primary production revealed from long-chain diols in the Neogene equatorial Pacific sediments

SAWADA, Ken[1*], KOBAYASHI, Madoka[1], YAMAMOTO, Shinya[2], NAKAMURA, Hideto[1]

[1]Faculty of Science, Hokkaido University, [2]Instit. Low Temp. Sci., Hokkaido Univ.

The eastern equatorial Pacific Ocean today sustains significant amounts of global marine productivity, and the region is one of the largest marine sources of carbon dioxide to the atmosphere. Nevertheless, geological time-scale variations of marine productivity and ecological / biogeochemical systems in the equatorial Pacific have been still unclear. It was obtained rough knowledge that marine productivity in the region was characterized by abundant diatoms since the late Oligocene to early Miocene. In this study, we reconstruct more detailed variations of primary productions by new diatom biomarker (long-chain diols) proxies from 'Pacific Equatorial Age Transect (PEAT)' sediments, and discuss evolution of the diatom-dominant ecosystem and the related paleoceanographic and paleoclimatic systems during the Neogene. In addition, we reconstruct variations in sea surface temperarture (SST) by long chain alkenone and the newest long-chain diol thermometers in these sediments.

Integrated Ocean Drilling Program (IODP) Expeditions 320/321, 'PEAT', recovered a Cenozoic sediment record from the equatorial Pacific by coring above the palaeoposition of the Equator at successive crustal ages on the Pacific plate. We used the cores U1335, U1336, U1337 and U1338 of the Neogene 'PEAT' sediments. The long-chain diols in marine sediments are mainly derived from diatom, and 28 carbon numbers (C_{28}) and C_{30} 1,14-diols are peculiar biomarkers of specific diatom genus Proboscia. These long-chain diols are used as upwelling indicator, diol index, which is the ratio of C_{28} and C_{30} 1, 14-diols to C_{30} 1,15-diols (Rampen et al., 2008, Earth Planet. Sci. Lett. 276, 207). Furthermore, Eustigmatophyceae are also known to have C_{28} and C_{30} 1, 13-diols, and more recently, these biomarkers are proposed as paleothermometer, which is the ratios of C_{30} 1, 15-diols to C_{28} and C_{30} 1,13-diols, called 'diol isomer index (DIX)' (Rampen et al., 2011, IMOG abstract).

We identify saturated C_{28} and C_{30} 1,13-diols, C_{28} and C_{30} 1,14-diols, and C_{30} 1,15-diol from almost all the early Miocene to Pleistocene PEAT sediments (23-0.23 Ma; cores U1335, U1336, U1337 and U1338). This indicates that diatom and eustigmatophyte algae productions were consistently significant in the equatorial Pacific throughout the Neogene. In particular, the diatom productions recorded by total diol concentrations increased at paleolatitude 2 ^{o}N-4 ^{o}N during 6 and 5-3 Ma, and at paleolatitude 2 ^{o}S-2 ^{o}N during 10-7 and 5-4 Ma. The diol (1,14/1,15) indices also varied, and higher diol index values suggest that upwelling more efficiently occurred in sea surface layers at paleolatitude 2 ^{o}S-4 ^{o}N since 16 Ma. However, their decreasing spikes appeared at 2 ^{o}S-2 ^{o}N during 8 Ma and 4 Ma and at 2 ^{o}N-4 ^{o}N during 4-3 Ma. The horizons of higher diol concentrations do not correspond to those of higher diol indices. Therefore, the increase of diatom production cannot be explained by only more efficient occurrence of upwelling in the equatorial zone. Diatom is known to need silica (Si) for its production, and Si is thought to be transported from land to ocean. Thus, the increase of diatom production in this study might be caused by increasing amount of terrigenous matter transported via atmosphere from land to the pelagic areas of the equatorial Pacific. From these insights, we suggest that variations of diatom productions are presumably attributed to changes in efficiency of upwelling and terrigenous input by aeolian transport in the equatorial Pacific during the Neogene.

The diol thermometer, DIX, values varied in the Neogene PEAT sediments. Variations in DIX-based SSTs were quite different from those in alkenone-based SSTs, which were nearly constant over the 15 Ma. The DIX-based temperatures might vary controlling by occurrence of cooler upwelling in the equatorial Pacific areas. These trends are concordant with that of the Neogene global paleoclimatic variation.

Keywords: Pacific Equatorial Age Transect (PEAT), marine primary production, sea surface temperature, diol paleothermometer, diatom production, Neogene paleoceanography

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-12 Room:101B Time:May 24 14:33-14:48

Paleoenviromental changes of the continental shelf in the Canterbury Basin based on benthic foraminiferal assemblages

OI, Takeshi[1*], KUSUNOKI, Satoko[2], ISHIDA, Katsura[3], Shungo Kawagata[4], Shiro Hasegawa[5]

[1]Human Resource Center for Innovation, Kumamoto University, [2]Graduate of Science and Technology, Shinshu University, [3]Department of geology, Faculty of Science, Shinshu University, [4]Faculty of Education and Human Sciences, Yokohama National University, [5]Graduate of Science and Technology, Kumamoto University

Introduction

The Quaternary benthic foraminiferal assemblages in top 74 m of two cores, Hole U1353B (hole depth; 211.48 m) and Hole U1354B (hole depth; 77.52 m) of IODP Exp. 317, were examined to understand the paleobathymetric and paleoclimatic history at the Canterbury Basin, New Zealand. The purpose of IODP Exp. 317 is to understand the relative importance of eustasy and tectonic and sedimentary processes in controlling the development of continental margin sedimentary cycles (sequences). Sites U1353 and U1354 provide a high resolution record of recent glacial cycles covering the middle to late Quaternary in a continental shelf setting (Expedition 317 Scientists, 2011). Top 74 m of these cores have the glacial-deglacial records since 0.5 Ma based on the datums of microfossils and the oxygen isotope curves.

Foraminiferal taxa group

We identified 50 genera and 95 species of fossil benthic foraminifera (>0.125 mm) in 120 samples of these core, and recognized 4 taxa groups, with different depth ranges in the present ocean around New Zealand (Hayward et al., 1999).

Taxa group 1 - *Bulimina marginata*, *Cassidulina carinata*, *Anomalinoides sphericus*, *Notorotalia zealandica* and *Sphaeroidina bulloides* - deep inner shelf to outer shelf (about 20-200 m in water depth)

Taxa group 2 - *Nonionellina flemingi* and *Angulogerina angulosa* - deep inner shelf to mid shelf (about 20-100 m in water depth)

Taxa group 3 - *Notorotalia finlayi*, *Notorotalia aucklandica*, *Quinqueloculina* spp. and *Cibicides* spp. - inner shelf (about 0-50 m in water depth)

Taxa group 4 - *Zeaflorilus parri*, *Elphidium charlottense*, *Haynesina depressula* and *Virgulopsis turris* - shallow inner shelf (about 0-20 m in water depth)

Paleoenvironmental changes

Based on the paleo-water depth estimated by benthic foraminiferal assemblages, the sediments of U1353B and U1354B since 0.5 Ma were divided to 7 bio-cycles. 1 bio-cycle represents from shallower taxa group to next shallower group via deeper taxa group. And each cycle may correlate to a glacial-deglacial cycle.

Subtropical benthic species, *Bulimina marginata*, is abundant during the three warmer periods (MIS 1, MIS 11, MIS 13). This species indicates that Canterbury Basin was warmer than modern in climate.

According to the previous studies on the Tertiary stratigraphy in Oamaru (Hornibrook et al., 1961), *Bolivina parri*, *Bolivina wanganuiensis* and *Siphotexturalia wairoana* were extinct at the boundary of Haweran and Castlecliffian in NZ stages, corresponding to 0.34 Ma. However, the present study represent that these highest occurrences were not the same, and seem to be controlled by the paleoenvironmental changes related to glacial-deglacial cycles.

Keywords: benthic foraminifera, paleobathymetry, continental shelf, Caterbury Basin, Pleistocene, IODP Exp. 317

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-13 Room:101B Time:May 24 14:54-15:09

Sedimentary and diagenetic history of Kita-daito-jima atoll for the last 25 million years

IRYU, Yasufumi[1*], TAKAYANAGI, Hideko[2], ISHIKAWA, Tsuyoshi[3], Kazuya Nagaishi[4], NAKAYAMA, Yuki[1]

[1]Tohoku Univ., [2]Nagoya Univ., [3]JAMSTEC, [4]Marine Works Japan

An old borehole, 432.7 m deep, drilled in 1934 and 1936 on Kita-daito-jima, northern Philippine Sea, reveals the reef evolution on this island during the Late Oligocene to Miocene. Four depositional units have been defined by lithological changes and are numbered sequentially from the top of the hole downward. The major lithology varies from bioclastic packstone/grainstone (unit C4) to coral rudstone (unit C3) to coral bafflestone (unit C2), implying a gradual shallowing of the lagoon. However, the coral fauna suggests that unit C1, above, formed on a submerged platform. Reef formation on Kita-daito-jima was controlled by the combined effects of sea-level changes and tectonic movements (subsidence and uplift). Two modes of reef formation have been recognized: growth that kept pace with the subsidence of the island; and rapid reef formation that commenced at sea-level falls. The latter indicated that sea-level falls are key events that revived drowned reefs. Dolomites extend in Kita-daito-jima from the island surface to a depth of 100 m below the ground surface (units C1 and C2). X-ray diffraction analysis indicates that the island-surface and borehole dolomites comprise variable mixtures of multiple dolomite crystal phases. Deconvolution of whole-rock isotopic and elemental compositions based on the relative abundance of phases reveals that each phase has a distinct chemical and isotopic composition. Oxygen isotopic compositions of the island surface and borehole dolomites suggest that all dolomite phases formed in seawater.

Keywords: Kita-daito-jima, shallow-water carbonate, dolomite, oxygen-isotope composition, strontium-isotope composition, seawater dolomitization

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-14 Room:101B Time:May 24 15:30-15:54

IODP Expedition 331 Deep Hot Biosphere

NUNOURA, Takuro[1*], TAKAI, Ken[1], IODP Exp331 onboard scientists[1]

[1]Extremobiosphere Research Program, JAMSTEC

The Iheya North hydrothermal field is located in the middle Okinawa Trough, an ac- tively spreading backarc basin that extends for 1200 km between the Ryukyu arc- trench system and the Asian continent, in a transitional region between continental and oceanic crust. Because the Okinawa Trough contains both hemipelagic and vol- canic sediment, in some places >1000 m thick, its hydrothermal systems provide abundant H2, CO2, CH4, NH4, H2S, and CO derived from sedimentary organic matter and from magmatic gases that could feed a variety of microbial communities, sus- tained by different chemolithoautotrophic primary producers within a range of sub- seafloor habitats. Integrated Ocean Drilling Program (IODP) Expedition 331, the Deep Hot Biosphere project, drilled into the Iheya North hydro- thermal system in order to investigate metabolically diverse subseafloor microbial ecosystems and their physical and chemical settings.

We drilled five sites during Expedition 331: the active hydrothermal vent site and sulfide-sulfate mound at North Big Chimney (NBC) (Site C0016); three sites east of NBC at distances of ˜100, 450, and 1550 m from the active vents (Sites C0013, C0014, and C0017, respectively); and one site on a hill ˜600 m northwest of the active vents that represents a potential migration path for hydrothermal fluid (Site C0015). Our maximum penetration was 151 meters below seafloor (mbsf) at recharge Site C0017. We will introduce summary of the drilling, geochemistry, mineralogy and microbiology among the sites, and discuss about the sub-vent hydrogeology of the hydrothermal field.

Keywords: IODP, Okinawa Trough, hydrothermal, subsurface biosphere, sub-vent biosphere

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-15 Room:101B Time:May 24 15:54-16:09

Summary of IODP Expedition 336

NAKAMURA, Kentaro[1*], Hisako Hirayama[1], HARIGANE, Yumiko[2], SAKATA, Kasumi[3]

[1]JAMSTEC, [2]AIST, [3]Osaka University

We will present the outline of the Integrated Ocean Drilling Project Expedition 336.

Keywords: IODP, North Pond, Mid-Atlantic Ridge, sub-surface ocean, deep biosphere

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-16 Room:101B Time:May 24 16:09-16:24

Impacts of results from IODP Expedition 324 (Shatsky Rise) on solid-earth science and Cretaceous paleoceanography

ANDO, Atsushi[1*], SANO, Takashi[2]

[1]Smithsonian Institution, [2]National Museum of Nature and Science

IODP Expedition 324 to Shatsky Rise was primarily aimed at elucidating the processes of the formation and evolution of oceanic plateaus based on the integrated analysis of the basement basaltic rocks by means of petrology, geochemistry, volcanology, radiometric geochronology, etc., with a special emphasis on testing the two competing hypotheses for the mechanism of oceanic plateau emplacement (mantle plume vs. peculiar plate tectonics). In terms of solid-earth science, several important new findings have already been made, including a large variety of magma chemistry, magma evolution at shallow magma chambers, and the deep origin for primary magma. On the other hand, this expedition was initially deemed to be unsuitable for the study of sediments/sedimentary rocks because of various restrictions from the drilling strategy, and actually the cored sedimentary materials were rather limited in quantity. Unexpectedly, postcruise study has brought about important new insights into Cretaceous paleoceanography, the outline of which is presented herein.

Through the drilling at Site U1348 on the northern summit of Tamu Massif, the presence of unconsolidated Cretaceous pelagic sediment cover was revealed, and paleoceanographically important intervals were captured, though poor in recovery. Of these, a short 1.4 m-thick interval of calcareous ooze in Site U1348-Core 2 has been accurately dated to be the Santonian-Campanian (S-C) transition, based on shore-based integrated stratigraphy of planktonic foraminifera, Sr isotopes and paleomagnetism. This finding is significant, because a major obstacle in Late Cretaceous paleoceanography has long been the lack of deep-sea sedimentary records across the S/C boundary resulting from the spatiotemporally extensive hiatus. The ooze lithology allows the acquisition of stable isotope data from very well-preserved, taxon-specific separates of foraminifera for the first time for the deep-sea S-C transition. The detailed benthic foraminiferal oxygen isotope data predict a sustained supergreenhouse condition until the end of the Santonian and a subsequent relatively rapid cooling (+1.0 per mil shift) within the early Campanian, opposing the preconceived view for a gradual cooling trend during this period.

In Site U1348-Core 10, another short interval (22 cm-thick) of calcareous ooze was recovered and dated onboard to be the early Aptian in age, thus representing the oldest known record of unconsolidated pelagic sediments recovered through the history of scientific deep-sea drilling. Detailed shore-based chronological assessments by means of planktonic foraminifera, carbon isotopes and Sr isotopes have been successful in placing the rigorous age constraints upon this interval at around the early/late Aptian boundary. Accordingly, it is certain that the deposition took place just after Oceanic Anoxic Event (OAE) 1a, and that the extension of the global stable isotopic compilation of deep-sea benthic foraminifera is possible to as old as ˜120 Ma. It is noteworthy that seismic interpretation indicates that the expanded, older pelagic sedimentary strata are present just to the south of Site U1348. Consequently, northern Tamu Massif of Shatsky Rise, where pelagic sediments are unconsolidated, thick and potentially dating back to the earliest Cretaceous (spanning the OAE1a interval), would be the ideal target area for future paleoceanographic IODP expedition.

This study is partly supported by IODP After Cruise Research Program, JAMSTEC.

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-17 Room:101B Time:May 24 16:24-16:39

Southern Ocean drilling proposal: Antarctic Cryosphere evolution project (AnCEP)

IKEHARA, Minoru[1*], NOGI, Yoshifumi[2], SUGANUMA, Yusuke[2], MIURA, Hideki[2], OIWANE, hisashi[2], KATSUKI, Kota[3], ITAKI, Takuya[4], NAKAMURA, Yasuyuki[5], KAWAGATA, SHUNGO[6], IWAI, Masao[1], SATO, Hiroshi[7]

[1]Kochi University, [2]National Institute for Polar Research, [3]KIGAM, [4]AIST, [5]JAMSTEC, [6]Yokohama National Univ., [7]Senshu Univ.

The Southern Ocean has played a significant role in the global climate system during the geologic past. In order to understand the paleoceanographic variations with the polar front system and Antarctic Circumpolar Current (ACC), we conducted two cruises KH-07-4 and KH-10-7 in the Indian sector of the Southern Ocean. Two piston cores were collected from the Conrad Rise. We examined centennial-scale changes of diatom assemblages and stable isotopic ratios in planktic foraminifera during the Holocene in a high-accumulation-rate sediment core from the Conrad Rise. Although abundances of dominant diatom taxa (Fragilariopsis kerguelensis and Thalassiothrix antarctica) are comparatively constant, relative abundances of secondary taxa fluctuate. Before ca 9900 cal. yr BP, winter sea-ice and cold water covered the Conrad Rise. Following deglaciation the sea-ice retreated from the Conrad Rise. The Polar Front moved southward during the early Holocene optimum and north Antarctic Zone waters covered the Conrad Rise for about 650 yr. After 9300 cal. yr BP, solar insolation strongly influenced sea surface temperature and primary productivity in the Southern Ocean. In the high-latitude Indian Sector, productivity increased 1500 yr after the onset of late Holocene neoglaciation. Periodic 18O and cold-water diatom taxa spikes (at intervals of 200 and 300?500 yr, respectively) occurred after 9300 cal. yr BP, probably associated with solar activity. Fluctuations in short-term sea surface temperature and cold-water taxa are synchronous with changes in dD observed in an east Antarctic ice core.

Keywords: Southern Ocean, Earth drilling science, paleoceanography, Antarctic Cryosphere, Antarctic Circumpolar Current, sea ice

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS27-18 Room:101B Time:May 24 16:39-16:54

IODP Exp. 346(Asian Monsoon): Return of JR to the Japan Sea and a new visit to East China Sea

TADA, Ryuji[1*]

[1]Graduate School of Science, The University of Tokyo

In the summer of 1989, during the phase of DSDP cruises Leg 127/128 were organized to drill the Japan Sea. It was a memorial in the respect that the cruises were led by two Japanese co-chiefs and 10 Japanese scientists in total participated. One of unexpected findings of the cruises was the occurrence of dark and light layers that were alternated throughout the Quaternary. These dark and light layers are correlatable basin-wide and deposited synchronously. The dark layers are org-C rich, partly laminated, and somehow resemble sapropels of Mediterranean. However, their sedimentary rhythm is more complicated than that of Mediterranean sapropels the latter basically reflect orbital cycles. The origin of the rhythm of the dark and light layers was mystery for some time until Tada et al. (1995, 1999) found that the rhythm resembles that of ?18O variations of Greenland ice cores in millennium time scale, so-called Dansgaard-Oeschger Cycles [DOC]. Subsequent studies on piston cores suggested that deposition of the dark and light layers reflects changes in properties of water influx through the Tsushima Strait due to the changes in contribution of the East China Sea coastal water relative to Kuroshio-derived water. Tada et al. (1999) hypothesized that changes in the relative contribution of the East China Sea coastal water reflected changes in discharge of Yangtze River which, in turn, reflected changes in EASM precipitation over the Yangtze River drainage. Recent provenance study of eolian dust in the cores from the Japan Sea further suggests that westerly jet axis over the Japan Sea oscillates in association with DOC (Nagashima et al., 2011). Because the westerly jet is bounding the northern limit of EASM front, it is likely that N-S oscillation of the westerly jet axis caused N-S movement of the northern limit of EASM front that resulted in the changes in EASM precipitation over the Yangtze River drainage in association with DOC. Thus, we further hypothesized that oscillation in westerly jet paths played a role of tele-connecting climatic changes in north Atlantic with changes in EASM intensity.

Expedition 346 is aimed to test these hypotheses. In addition, the expedition aims to specify the timing of onset of DOC type millennial-scale variability of EASM, its mode of evolution, and changes in mode, frequency, and amplitude of variability of EASM in association with glacial-interglacial cycles. The relation between East Asian summer and winter monsoons and its changes through time will be another interesting objective of the expedition. The paleoceanographic condition of the Japan Sea has been very sensitive to the nature (e.g., salinity, temperature, nutrients, and etc.) and the amount of the influx to the sea as well as sea level and climate in the surrounding region, and drastically changed in various time scales throughout its history. Consequently, there will be many interesting topics other than the major objectives of the expedition. IODP cruise will provide a rare opportunity to work with international community who share similar scientific interests. Participation of young generation with innovative ideas is welcome.

Keywords: IODP, Exp. 346, Asian Monsoon, Japan Sea, East China Sea, Abrupt climate change