

MIS022-P01

Room:Convention Hall

Time:May 23 14:00-16:30

The changes of paleoceanography from benthic foraminiferal assemblages on the continental shelf of the Canterbury Basin

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The Quaternary benthic foraminiferal assemblages in cores at continental shelf of the Canterbury Basin (Hole U1353 and U1354 of IODP Exp. 317), were examined to understand the paleoceanographic history. The purpose of 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 Holocene and late Quaternary in a continental shelf setting.

In the Pleistocene section, two alternating benthic foraminiferal assemblages were recognized. One assemblage consists mainly of *Notorotalia inornata* and *Elphidium charlottense* associated with *Zeaflorilus parri*, suggesting a shallow inner shelf environment. The other consists of *Notorotalia aucklandica*, *Nonionella flemingi* and *Anomarinoides sphericus*, implying a deeper depositional environment down to outer shelf.

Thus, these alternation of two assemblages is considered to represent the frequent paleo-depth changes between inner shelf and outer shelf or deeper. We will discuss the relationship between faunal changes and eustatic sea level changes.

Keywords: fossil benthic foraminifera, paleoceanography, the continental shelf of the Canterbury Basin, late Pleistocene, IODP Exp. 317

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Plio-Pleistocene fossil ostracodes of continental shelf cores at IODP Site U1354 (Exp. 317), Canterbury Basin

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Integrated Ocean Drilling Program (IODP) Expedition 317 was devoted to understanding the relative importance of global sea level (eustasy) versus local tectonic and sedimentary processes in controlling continental margin sedimentary cycles. The expedition recovered sediments from the Eocene to recent period, with a particular focus on the sequence stratigraphy of the late Miocene to recent, when global sea level change was dominated by glacioeustasy. Drilling in the Canterbury Basin, on the eastern margin of the South Island of New Zealand took advantage of high rates of Neogene sediment supply, which preserved a high-frequency (0.1-0.5 m.y.) record of depositional cyclicity. Ostracodes are benthic micro-crustaceans that widely inhabit marine, brackish, and non-marine environments. Shallow marine species have more restricted habitat and respond sensitively to environmental changes. Therefore they are a useful tool for high-resolution analyses of paleoenvironmental changes.

We investigated samples during Plio-Pleistocene sections from Site U1354 (Hole U1354B and C; 75-375 m below seafloor; ~1.2 to 4.3 Ma), which is in an intermediate position within the three shelf sites transect of Expedition 317. Samples were examined at 1.5 m depth intervals (~15-20 kyr intervals) at 75-110 m below seafloor and 10 m (~100 kyr) intervals at under 110 m below seafloor. Fossil ostracodes occurred from all 41 samples that we used. Numbers of ostracode species and specimens/g sample increase upward. Five species of ostracodes *Argilloecia* sp., *Callistocythere* sp., *Cytheropteron* cf. *abyssorum*, *Hemicytherura* sp., and *Munseyella brevis* were contained abundantly through whole samples. Relative abundance (%) of *Munseyella brevis*, that lives on the shelf area at east of the south land of New Zealand, versus *Argilloecia* sp. that lives in cold and deep sea and *Cytheropteron* cf. *abyssorum* that lives around Antarctica shifted constructively. These changes are supposed to be relative sea level changes. We expect to reveal detailed environmental changes by using data of such as calcareous nannofossils stratigraphy.

Keywords: IODP Exp. 317, Canterbury Basin, fossil Ostracode, Plio-Pleistocene

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Paleoceanography based on Pliocene and Pleistocene diatom floras from the Canterbury Basin (IODP Ex. 317)

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Diatom analyses of the upper Pliocene and Pleistocene sediments (from ca 2,780 to 290 ka after results of onboard calcareous nannoplankton biostratigraphic research) in the Canterbury Basin continental slope (Hole U1352B of Integrated Ocean Drilling Program Expedition 317) revealed strong warm and cold fluctuations which might coincide with global benthic foraminiferal $\delta^{18}O$ records, in addition to three times trans- and degression events, although the preservation and occurrences were generally poor and rare and the diatom biostratigraphic events were unknown. Moreover, abundant occurrence of diatom resting spores from ca 1,700 to 1,000 ka may indicate that eutrophication advanced around coastal region after upwelling strengthened, and nutrients supplied unstable and sporadically from 1,250 to 1,000 ka.

Keywords: IODP Expedition 317, New Zealand, diatoms, nannofossils, paleoceanography, Canterbury Basin

MIS022-P04

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Time: May 23 14:00-16:30

Quaternary tephrostratigraphy in IODP exp.323 cores (U1343 and U1344) collected from the Sea of Bering

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Tephra layers constitute valuable stratigraphic markers. In this study, we analyzed eighty-two tephra samples in IODP exp.323 cores (U1343 and U1344) collected from the Sea of Bering, describe their petrographic and geochemical characters, and reveal tephrostratigraphy.

Sediments cores U1343 (water depth 1956 m) and U1344 (water depth 3174 m) were collected from the center part of the Sea of Bering and near the Bering Self sloop. Sediment mainly constitutes of diatomaceous clay to silt. The core U1343 include total forty-eight tephra samples from four Hole cores, 13 samples in Hole U1343A (total length: 201.5 mbsf), 9 samples in Hole U1343C (total length: 234.2 mbsf), one sample in Hole U1343D (total length: 8.5mbsf), and 25 samples in Hole U1343E (total length: 744.3mbsf). Paleomagnetism suggests that sediments in the Hole U1343A and Hole U1343C are the continuous records during last 800 ka approximately, and the bottom of sediment in Hole U1343E reach at the 2.1Ma. The core U1344 include thirty-four tephra samples from three Hole cores, 27 samples in Hole U1344A (total length: 745.0 mbsf), 6 samples in Hole U1344D (total length: 286.5 mbsf), and one sample in Hole U1344E (total length: 202.8 mbsf). Paleomagnetism suggests that sediments in the Hole U1344D and Hole U1344E are the continuous records during last 600 ka approximately, and the bottom of sediment in Hole U1344A reach at the 1.9Ma.

Tephra samples were (1) washed by ultrasonic cleaner, (2) sieved by 63, 125 and 250 micrometer size and to recover the 63-125 micrometer size fraction, and (3) grains examined under a binocular/polarizing microscopes to describe their form, color and mineral assemblage. The chemical compositions of volcanic glass shards in the 63-125 micrometer size fraction were determined using a wavelength dispersive electron probe micro-analyzer operated at 15 kV and using a 10 nA beam current and a 10 micrometer beam diameter to minimize loss of Na and K.

Most of tephra samples include rounded rock fragments, rounded and weathered minerals, quartz and plagioclase. Furthermore, foraminiferal fossils and diatom fossils are contaminated in most samples. In every tephra sample, volcanic glass shards in the 63-125 micrometer size fraction are observed and also volcanic glass shards are concentrated under the 63micrometer size. On basis of major-element composition of glass shards in 82 samples, SiO₂ in glass shards is between ca.53 wt% to ca.78 wt%. Vitric tephra samples which are characterized by high-SiO₂ content (ca. 71wt% to 78 wt%) were found in five in the core U1343, and two in the core U1344. They are rich in clear and bubble-wall type volcanic glass shards and rarely heavy minerals. The size fraction of volcanic glass shards is concentrated under 63 micrometer.

Rock fragments and minerals are considered as to be transported by seasonal sea-ices and ice-bergs, not to fall out accompanying volcanic eruptions, because almost they are almost rounded. On basis of major-element composition of volcanic glass shards, eighty-two samples can be divided to two groups (Type 1: high CaO-MgO type, Type 2: low CaO-MgO type). Also, SiO₂ of Type 1 tephra is ca.58-63wt% and Type 2 is ca.65-78wt%. Such geochemical characters suggest that Quaternary tephra beds in the central of the Sea of Bering have been provided from at least two volcanic zones.

Five tephra beds in the core U1343 are divided to Type 2. Furthermore, three of them and two of them in different Hole are correlates respectively: 93.825 mbsf in Hole U1343E (ca 0.37Ma; thickness is 3.5 cm), 97.835 mbsf in Hole U1343C (ca.0.29Ma: thickness is 2 cm), and 98.868 mbsf in Hole U1343A (ca.0.33Ma: thickness 4cm). SiO₂ contents in three samples are ca.75wt%. 190.850 mbsf in Hole U1343E (ca.0.78Ma: thickness is 1 cm) and 193.795 mbsf in U1343C (ca.0.78Ma: thickness 2 cm) are correlated each other. SiO₂ contents in two samples are ca.78wt%.

With collaboration of the IODP Exp.323 science party

Keywords: tephrostratigraphy, the Sea of Bering, Quaternary, EPMA

MIS022-P05

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Pleistocene foraminiferal oxygen and carbon isotope records in the Bering Sea (IODP EXP. 323 Site U1343)

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Sea ice history in the northern hemisphere provides insight to understand the cooling mechanism since the Northern Hemisphere Glaciation (NHG). IODP Expedition 323 recovered first appropriate sediments in the Bering Sea to see sequential record during whole Pleistocene. Among the seven sites drilled during this expedition, Site U1343 is situated at the Beringian slope that is proximal to the current seasonal ice-margin. To augment shipboard data, we have generated oxygen and carbon isotope record of planktic and benthic foraminifers. Inter-species calibration of benthic foraminiferal oxygen isotope provides well-established composite oxygen isotope record during last 2.1 Ma. Oxygen isotope stratigraphy during last 0.6 Ma reasonably matches to the biostratigraphy age-model on-board. Carbon isotope of both planktic and benthic foraminifer above 200m CCSF-A shows partial contamination from the interstitial water with light ^{13}C , produced by the bacterial activity in the Sulfate-Methane Transition Zone. Concurrence of colored foraminifer shells presence at those contaminated interval suggests the alteration process between foraminifer shells and the interstitial water. Contaminated data can simple be excluded by using statistical model and the presence of colored shells. Oxygen and carbon isotope records shows notable shift after the Mid-Pleistocene Transition (MPT). Long-term trend of foraminiferal oxygen and carbon isotope with changes in the sea-ice related flora indicate progressive sea-ice formation after the MPT. This sea-ice formation is attributed to the less ventilation between surface and deep water, hence formation of the oxygen minimum water around 2000m depth in the Bering Sea.

Keywords: foraminifer, oxygen isotope, carbon isotope, Bering Sea, Pleistocene

MIS022-P06

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Distribution of hydrothermal clay minerals in cores obtained by IODP Exp.311 from the Iheya North Knoll, Okinawa Trough

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An active hydrothermal field at the Iheya North Knoll, Okinawa Trough, was the subject of detailed investigations during the Integrated Ocean Drilling Program (IODP) Expedition 311, conducted in September, 2010. Five sites were drilled during the expedition : the active hydrothermal mound (Site C0016), 600 m northwest of the mound (Site C0015), 100 m east of the mound (Site C0013), 450 m east of the mound (Site C0014) and 1550 m east of the mound (Site C0017). Mineralogy and geochemistry of hydrothermal clay minerals of the core samples were studied in order to reveal physical and chemical condition below the seafloor based on their vertical and lateral distribution.

Grain size separation in silt (2-63 micrometer) and clay (<2 micrometer) fractions according to Stokes' law was performed by setting powdered core sediment in a standing cylinder. Mineralogy of the bulk sediment and of the clay fraction was determined by X-ray diffractometry (XRD). For the clay fraction, measurements were carried out on air-dried, ethylene glycol-saturated, HCl-treated and heated (200 - 300 degC) condition, in order to identify clay minerals. Morphology of the clay minerals was observed using transmission electron microscopy (TEM), at 200kV accelerating voltage in the Research Laboratory for High Voltage Electron Microscopy, Kyushu University. Chemical composition of the clay minerals was obtained in TEM observation using energy dispersive spectrometry (EDS).

Vertical distribution of clay minerals from site C0013 (100 m east of hydrothermal mound) was summarized followings, where dominant clay minerals were listed up.

UnitI (0 - 4.5~6.8 mbsf) : kaolinite, illite, pyrite and quartz from 1 mbsf; smectite, barite and sphalerite from 4.7 mbsf

UnitII (4.5~6.8 - 12 mbsf) : chlorite, chlorite-smectite mixed layer mineral, smectite, anhydrite, gypsum and pyrite

UnitIII (12 - 23 mbsf) : chlorite, anhydrite and pyrite

UnitIV (23 - 55 mbsf) : chlorite and quartz

Vertical distribution of clay minerals from site C0014 (450 m east of hydrothermal mound) was summarized as follows.

UnitI (0 - 12~16 mbsf) : quartz, muscovite and calcite dominantly; opaline silica, cristobalite, feldspar and chlorite (probably detrital) according to the onboard study

UnitII (12~16 - 29 mbsf) : kaolinite and smectite from 13 mbsf; smectite and cristobalite from 17-20 mbsf; illite-smectite mixed layer mineral and illite from 21-23 mbsf; chlorite and chlorite-smectite mixed layer mineral from 26-28 mbsf; quartz and pyrite

UnitIII (29 - 128 mbsf) : chlorite and illite; chlorite dominantly above 40 mbsf and illite dominantly below 40 mbsf; quartz and pyrite; anhydrite and gypsum from 65 mbsf

Diverse occurrence of clay minerals was notable in both Sites C0013 and C0014. The occurrence of clay minerals at the Iheya Knoll hydrothermal field is characterized by a systematic change with depths, from smectite near the seafloor, then mixed layer minerals, to chlorite and/or illite in the deeper portion. This change is likely to reflect an increase in temperature with depth. With analogical inference based on geothermal field studies, the temperature profile at Site C0014 is considered as 100 to 200 degC at 17 to 29 mbsf and > 200 degC below 29 mbsf. According to the onboard study report, measured temperatures at Site C0014 were 55 degC at 16 mbsf, 135~145 degC at 47 mbsf and > 210 degC at 50 mbsf. At Site C0013, the clay mineral change was observed at shallower depth (0 - 12 mbsf) than in Site C0014 and the dominant occurrence of chlorite below 12 mbsf indicates that temperature was > 200 degC. This vertical distribution is in accordance with larger temperature gradient in the vicinity of the center of the hydrothermal field.

Keywords: Iheya North Knoll Okinawa Trough, IODP Expedition 311, hydrothermal clay minerals, hydrothermal alteration, X-ray diffractometry (XRD), transmission electron microscopy (TEM)

MIS022-P07

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Petrology of large lava flow off the East Pacific Rise : Crystallization process of the large ponded lava from ODP hole

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Petrology of large lava flow off the East Pacific Rise : Crystallization process of the large ponded lava from ODP hole 1256C

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91°56.1'W on the 3650-m deep Guatemala Basin on the Cocos plate formed at ~15 Ma at the East Pacific Rise. A large off-ridge lava flow 75-100m in thickness and ca. 10 cubic kilometers in volume was drilled at site 1256, providing a unique opportunity to understand the inner structures and solidification and emplacement processes of an off-ridge large lava flow. Hole C penetrated a 35-m thick lava from 280 mbsf to 315 mbsf. We present mineral compositions and grain size analyses of the core sample from hole 1256C, and discuss the crystallization and emplacement processes of the large off-ridge lava flow.

Phenocrysts are olivine, clinopyroxene and plagioclase, and the groundmass minerals are clinopyroxene, plagioclase and magnetite. Varioles are present in the upper and in lower sections with a few biotite in granophyre veins in the middle. The lava flow consists mostly of NMORB with high-K2O EMORB intervened at a depth interval of 290-300 mbsf (Wilson, et al., 2003). High-K2O EMORB has high-Mg# (60~70) clinopyroxenes and is interpreted to have intruded into the solidifying lava body at the final stage of the lava emplacement.

Just above the EMORB is the level of the most differentiated lava that has low-Mg# (50~60) clinopyroxenes, granophyric veins and pods. Plagioclase and clinopyroxene crystals are largest in this level. These facts indicate that increase in water content in the residual liquid with the crystallization differentiation reduced magma viscosity and resulted in crystallization of biotite-bearing granophyre and the largest crystal sizes.

I compared olivine phenocryst size distribution and number density distribution with phenocrysts sedimentation model of Rowland and Walker (1988). In cases where phenocrysts sedimentation velocity faster than cooling rate of lava body, olivine phenocrysts have slightly in uppermost part and have very few in upper part. In upper two third of olivine phenocrysts increase rapidly to maximum volume and decrease by degrees for lower section. Two parts that lower section and direct top of layer of intruded EPMA suggests these similar pattern with lower section of phenocrysts sedimentation model. It shows two lower sections in this lava body. The fact cannot explain by one lava flow, more than once lava flow units grew together and then intruded EMORB at the center.

Pigeonite occurs through the whole section as a discrete crystal in some cases and more commonly enclosed by augite. Augite has Mg#60~75, Al₂O₃ 1.5~2.0 wt%, TiO₂ 0.6~0.8 wt% except 292 mbsf. Pigeonite has Mg#65~70, Al₂O₃ 0.8~1.1 wt%, TiO₂ 0.3~0.4 wt%. Pigeonite and augite in contact with each other is considered to be in equilibrium in terms of Fe-Mg distribution. However, augite crystals away from the contact with pigeonite inclusions are disequilibrium with the pigeonite. This suggests that augite including pigeonite was incorporated into the host magma which was unsaturated with pigeonite.

Keywords: off-ridge lava flow, olivine phenocrysts, pigeonite

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Magnetic fabric of sediments in a pre-subducting oceanic plate: results from IODP Expedition 322, Sites C0011 and C0012

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Recent progress of Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) has revealed dramatic segregation in stress and strain across the transect of Nankai accretionary prism. According to the results from the Integrated Ocean Drilling Program (IODP) Expedition 316, magnetic fabrics at the prism toe (Sites C0006 and C0007) was represented by typical vertical and horizontal maximum principle strain axis in the upper and lower part of the boreholes, respectively. The question arose was how that lower horizontal compression zone extends seaward, which can also be a clue to understand propagation of the decollement and/or initiation of deformation in the subducting sediments. Here we present preliminary results of magnetic fabric analysis of the presubducting sediments at Sites C0011 and C0012 recovered during Expedition 322. Results show generally oblate magnetic ellipsoids throughout the holes with slight increase in the degree of anisotropy. The minimum axis of the magnetic ellipsoid (K3) shows very steep inclination in both Sites C0011 and C0012, which suggests that the horizontal compression observed in Sites C0006 and C0007 does not extend to these input sites. The slight difference in the K3 between upper and lower part at Site C0012 may reflect the tectonic history at this unique location of the top of Kashinosaki Knoll, however, further investigation is necessary for discussion.

Keywords: Nankai Trough, NanTroSEIZE, accretionary complex, D/V Chikyu, Anisotropy of magnetic susceptibility

MIS022-P09

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Reconstruction of history of sand supply into the Kumano Forearc Basin by IODP Core-Log Integration

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Downhole logging data combined with core data are useful to determine physical properties and lithology of the formation. However, layer-by-layer analyses were not routinely conducted especially for marine siliciclastic sediments due to poor core recovery. We attempted to reconstruct poor recovery intervals in the Kumano Basin using core-log integration method.

During Integrated Ocean Drilling Program (IODP) Expeditions 314/315, Site C0002 was drilled, logged, and cored down to 1400 meters below seafloor (mbsf). Stratified structures are clearly imaged by a seismic reflection profile in the southern edge of the Kumano Basin including Site C0002 area. A 935m-thick basin fill and accretionary prism were drilled and logged with Logging-While-Drilling (LWD) at Hole C0002A and high quality data were continuously acquired. Coring operations were conducted at the intervals 0-204 and 475-1057 mbsf in Hole C0002B and C0002D. Although the two holes are close enough to correlate.

We compared lithology of the recovered cores with log data, mainly resistivity and natural gamma ray, in the two cored intervals. As the core recovery was good throughout the upper interval, clear correlations are recognized between the lithological variations and log responses. Most of the sand layers are characterized by low gamma ray and low resistivity values. In the lower interval, where cores were recovered by the RCB system, the core recovery was poor and the dominant lithology is mudstone. However, the log responses suggest that the lower interval are composed of alternating beds of sandstone and mudstone. The thickness of LWD-based mudstone coincides with the thickness of recovered sediments (=mudstone), suggesting that the recovered cores represent highly biased lithology due to extremely low recovery of sandstone.

The total recovery length of mud coincides with the total thickness of mud layers estimated from logging data even in the low recovery (37.6%) of the lower interval. It can be said that only muds were successfully recovered and most sands were washed out. Based on the core-log integration studies, the LWD-derived lithology can be applied for the entire section of the hole including non-cored and poorly recovered intervals. This study successfully reconstructed the history of sand supply into the Kumano Basin, and enables us to continuously estimate eustatic sea-level changes.

Keywords: Integrated Ocean Drilling Program (IODP), LWD (logging-while-drilling), resistivity, natural gamma ray, methane hydrate, core-log integration

MIS022-P10

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3D X-CT core image analysis approaching with seismic interpretation

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We proposed new approach to analyze 3D X-CT core image with seismic interpretation software.

3D X-CT image has been recently used for analysis of core sample due to its non-distractive measurement and high resolution imaging. For example, all core samples acquired in JAMSTEC drilling research vessel CHIKYU are measured with 3D medical X-CT prior to other measurements. The data is utilized for quick look to determine sampling position and following measurement strategy. The data are also used farther research after the cruise.

A lot of commercial and free software for 3D X-CT image are sold and distributed, but they target medical users. Therefore the visualization, measurement and database are customized for medical examination and client database. Some commercial ones which handles 3D image are expensive.

On the other hand, many 2D/3D seismic visualization and interpretation software has been developed for oil industry and earth science. They have many geological and geophysical functions, for example structural interpretation, faults (fracture) modeling, arithmetical operation, image filtering used for fracture and texture analysis, attribute analysis, which can be very useful for core analysis as well.

We import 3D X-CT core image data measured with medical and industrial CT scanner to seismic interpretation software, and introduce the analysis results and potential.

Keywords: 3D X-CT, core analysis, seismic interpretation

MIS022-P11

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X-ray CT analysis and density estimation using a sediment core in cold-water coral mound provinces

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Three-dimensional quantitative analysis using X-ray computerized tomography (CT) analysis combined with X-ray radiographs and line-scan digital core images of a marine sequence recovered from near Challenger Mound in the Porcupine Seabight, off western Ireland during the Integrated Ocean Drilling Program (IODP) Expedition 307, is an effective method for core characterization. This allowed three-dimensional examination of complex shapes of corals fragments, dropstones, pebbles, and ice-raftered debris in sedimentary sequences. This paper confirms that X-ray CT proves to be a relatively quick and accurate method for high-resolution and non-destructive analysis of three-dimensional internal structures of core samples without the special sample preparation. A medical CT system at relatively low resolution provides an image of the large-scale features and allows correlation with core samples, and has generally been used due to their availability and relative ease of use. CT scanning just after coring and before splitting may be efficient to avoid a degradation of cores. Effective and efficient use of X-ray CT systems allows for the possibility for rapid systematic characterization of three-dimensional structural features, and may improve sub-sampling and core-processing procedures.

Because X-ray attenuation is sensitive to density variations, X-ray CT systems also offer the possibility of quantitative density measurement. Its rapid and quantitative results can easily be used to map subtle detailed density variations in three-dimensions. A relationship between CT numbers and measured densities by the GRA and the mass/volume method is consistent with previous studies. Standard conventional techniques for bulk density analysis in sediment cores use raw data from GRA or mass/volume method. Density values by standard conventional techniques represent the gross average. Neither have a spatial resolution better than X-ray CT data-derived density. Moreover, X-ray CT data-derived density offers advantages over these standard conventional techniques as it gives a three-dimensional distribution anywhere in the sample. Also, because of the simple process of the conversion from CT number to density, it is expected to reduce the possibility of human error.

Keywords: X-ray CT, bulk density, sediment core, Integrated Ocean Drilling Program (IODP), Expedition 307

MIS022-P12

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Upgrade development of a deep all core wire line drilling for sedimentary soft rock in coastal area

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In the all core drilling deeper than 200m in depth, it is generally adopted to a wire line (WL) core drilling method which have higher advantage of certainly and working efficiency than an usual drilling methods which is constantly entering and withdrawing all drill pipes, tubes and so on. However, a WL core drilling method was developed for the hard rocks, and the issue to be solved is the improvement of a coring technique for the soft rocks. We carried out the deep drilling survey to the depth of 1,004m. The drilling site locates the coastal area of Horonobe town in Hokkaido and the subsurface geology is composed of sedimentary soft rocks (mud, sand and conglomerate). It was concerned the occurrence of sloughing and the reduction of core collection rate. Therefore, we selected the PQ-WL drilling method combined with a high viscosity and low dehydrating drilling mud. And a new WL drilling tools, composed of the over-size reamer and the WL single core tube, have been developed to prevent an excessive rise of water pressure and to remove sloughed cuttings quickly. As a result, we have succeeded in keeping a high core collection rate (over average 90%) and getting a good quality core.

Keywords: Coastal area, Sedimentary soft rocks, All core wire line drilling, Upgrade development