

Hydraulic properties and pore structure of the sedimentary rocks at Site C0020, IODP Expedition 337 in Sanriku-oki basin

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Microbial biomass in the ocean sediments is controlled by physical, chemical and biological factor and conditions. The biomass in sediments reduces with increasing depth, and the limit of life and the reduction rate of biomass is partly controlled by physical conditions because lithification and diagenesis of oceanic sediments induce reduction of porosity, permeability and pore size. However the relationship between biomass and physical property for deep oceanic sediments is not well known. Therefore, in this study, a series of physical property measurements (Water potential, permeability and porosity) were conducted on the sediment cores at site C0020 from IODP expedition 337 and at site 902 from the Chikyu shakedown cruise (CY06-06) in Sanriku-oki basin. We measured water potential under atmospheric condition and permeability under confining pressure up to 40 MPa. Then we estimated the correlation between water potential and microbial biomass in the sediments.

Keywords: permeability, water potential, water activity, off-Sanriku basin, IODP expedition 337, biomass

Coring disturbances with the riser drilling system of the D/V Chikyu during IODP Exp. 337 off Shimokita, Japan

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Coring disturbances were observed using the riser drilling system of the D/V Chikyu during IODP Exp. 337 off Shimokita, Japan. Injections of drilling mud and fluid with high density and pressure used in riser drilling during Expedition 337 caused complications to visual core observations. Semiconsolidated materials were commonly observed in this Hole, and drilling mud often easily penetrated the semiconsolidated sandstones and siltstones, causing possible false lamination structure in the cores, which might be misinterpreted as natural sedimentary structure preserved in the cores. Here, we report various kind of coring disturbances which were observed on board with riser drilling system.

Keywords: Coring disturbance, riser drilling, IODP, Exp. 337

Lithology and XRF analysis data at drilled Site C0020 off the Shimokita Peninsula, IODP Exp. 337

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Marine subsurface hydrocarbon reservoirs and the associated microbial life in continental margin sediments are among the least characterized Earth systems that can be accessed by scientific ocean drilling. We penetrated a 2,466 m-deep sediment sequence with a series of coal layers around 2 km below the seafloor. Here, we present the 160 XRF data and lithology of sediments and paleoenvironments from drilling Site C0020, IODP Expedition 337. We defined four different lithologic units present in Site C0020. The succession of lithofacies at Hole C0020A also provides insight into the evolution of depositional environments in this region.

Keywords: Lithology, XRF, IODP, Exp.337

Structural characteristics of Nankai accretionary prism at C0002: Preliminary results from IODP Expedition 348

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Integrated Ocean Discovery Program (IODP) Expedition 348 has deepened hole down to 3058.5 mbsf at Site C0002, and collected cutting and core samples of Upper Miocene Nankai accretionary prism. The structural key observation made on cuttings in Holes C0002N and C0002P, and cores retrieved in Hole C0002P are:

a) The structures observed in intact cuttings include slickenlined surfaces, scaly fabric, deformation bands, minor faults and mineral veins. Slickenlines are observed throughout the whole interval, but scaly fabric is increasingly observed below ~2200 mbsf. The other types of structures are scattered throughout the whole section.

b) The cored interval is characterized by steep bedding planes (more than 75°). A fault zone, 90 cm in thickness, with a few mm-size angular clasts is present in one of the cores (2204.9~2205.8 mbsf). In its present position, the brittle fault zone is associated with a normal faulting sense. It is unclear if this represents an early thrust rotated after its development or late normal fault.

c) SEM images in the upper part of Hole C0002N show little evidence for opal diagenesis, implying $T < 60-80$ °C at 1225.5 mbsf. In Hole C0002N, the fabric lacks a strongly preferred orientation in clay-rich materials, except along striated micro-faults formed by clays. These zones are extremely localized with a thickness of a few microns or less. In Hole C0002P, below 2200 mbsf, SEM images show the development of a regularly spaced fabric in sandstones, constituted by thin (<0.1 μm), clay-dominated shear planes. Towards the base of the hole, below 2625 mbsf, compaction fabrics in clay-rich materials can be observed. Very thin shear zones with almost no wall damage zone have cut this fabric.

The overall character of the deformation (independent particulate flow with limited evidence for cataclastic deformation) is suggestive of that deformations occurred in a relatively shallow environment (approximately 0-4 km in burial depth).

Keywords: Expedition 348, C0002, Fault zone, Core, Cuttings

Seismic reflection survey investigating subduction inputs at the Sagami Trough

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The Sagami Trough is a plate convergent zone of the Philippine Sea Plate underneath the NE Japan including the Kanto area. Varied seismic events occurred associated with the plate convergence. Magnitude (M) 8-class earthquakes, for example 1703 Genroku and 1923 Taisho-Kanto events, damaged the Kanto area seriously. On the other hand, slow-slip events have been observed in the Boso area with 5-7 year interval, whose released energies were comparable to Mw 6. Source depths of the M8-class earthquakes and slow-slip events are almost same. One possible reason of the varied seismogenesis is different subduction inputs at the Sagami Trough. To understand the varied seismogenesis, structural and material information are important. A drilling proposal for subduction input at the Sagami Trough is planned to be submitted. Japan Agency for Marine-Earth Science and Technology was conducted a seismic reflection survey in April, 2013 at the southward of the Sagami Trough on the Philippine Sea Plate. Although a planned seismic line had been 270-km length at the 50-km southward of the trough in WNW-ESE direction, acquired data is limited in half of the planned line for rough weather from volcanic front to landward slope of the trench axis, showing sediment distribution and basement morphology. Sediments can be divided in three units. Basement morphology is rugged as basement highs reaching seafloor at the volcanic front and rising at the Frontal Arc and Outer Arc High of the former arc in the Izu-Ogasawara area, and as depressions as 4-km from seafloor filled by thick sediments. The sediments and basement are comparable to those in the vicinity of the Sagami Trough using conducted seismic profiles at the cross points. In this presentation, we will show the seismic profiles around the Sagami Trough, deduce the ages and materials of sediments and basements comparing previous results, infer the subduction inputs of the Sagami Trough, and discuss the seismogenesis around the Sagami Trough.

Keywords: MCS survey, Sagami Trough, subduction input

Core quality evaluation with X-CT data

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X-ray Computed Tomography (X-CT) is a powerful tool for an observation of internal structures and conditions of core samples. In the laboratory of D/V Chikyu, X-CT data has been used in initial evaluations of sample lithology, structure and physical properties such as density, before splitting the sample. In addition, the non-destructive measurement is particularly useful to evaluate the sample quality, based on which we can optimize the sampling and sample distribution plan. For example, intact pieces are passed to high-priority and contamination-sensitive analyses after observation of X-CT image. However, the evaluation of core quality has been mostly based on visual observation. While visual observation is good for quick evaluation, it sometimes lacked consistency and detailed survey.

In this study we propose a quantitative way to evaluate the core quality from X-CT data. The core quality index (CQI) is calculated as the ratio of area with CT value higher than a threshold value in a sliced image of core sample. The threshold value is determined from the representative CT value in the core section and varies depending on lithology. The data in the region of interest, which is 15 cm² of central part of core sample, is binarized with the threshold value to provide normalized index through all sections. The plot of CQI reveals the position and degree of damages inside a core sample.

The method is applied to X-CT data of a total of 176 sections from IODP Exp 337. The results show that CQI profile clearly differentiates intact part and disturbed part of core section. Comparison with other core quality indicators in pore water chemistry and chemical tracer experiments suggests that CQI can be used to identify intervals suitable for contamination-free sampling.

The figure shows an example of binarized X-CT slice of a core sample. Red in the central part (purple) shows porous part in the core sample.

Keywords: Chikyu, IODP, X-CT, core sample

