

アラスカ沖における第四期放散虫生層序 (IODP Exp.341 Site U1417) Quaternary radiolarians biostratigraphy in the Alaska margin (IODP Exp.341 Site U1417)

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The Gulf of Alaska is marked by the St. Elias orogen largely influenced by the ice-sheet expansion over the past 10 Myr. In this context, the Integrated Ocean Drilling Program (IODP) Expedition 341 drilled several sites in southern Gulf of Alaska in order to determine the linkage between the tectonic uplift, erosion by ice sheet and climate changes since Miocene. Concerning the paleontological aspect of the collected cores, siliceous microfossils were not abundant. Cores collected from Site U1417 present the highest abundance in siliceous microfossils. Indeed, in Site U1417, siliceous microfossils present moderate abundance for the upper 200 meters CCSF-B, which correspond to the Pleistocene. This interval is composed of dark gray mud with several interbeds of diatomaceous oozes. For deeper intervals, siliceous microfossils abundances were low, with numerous barren intervals.

Therefore, in this study, samples from the upper 200 m CCSF-B of Site U1417 were analyzed in order to establish the depth-age model based on shipboard diatom/radiolarian biostratigraphy and paleomagnetic polarity stratigraphy for enables further paleoceanographic studies. Indeed, several radiolarian datum events such as the last occurrences (LOs) of *Stylatractus universus*, *Lychnocanoma sakaii* and *Amphimelissa setosa* appear to be important for chronostratigraphic use. Particularly, temporal distribution of *Amphimelissa setosa* is highly interesting because the LO records at the MIS 4/5 boundary (77 ka) in the North Pacific, while this species is still extant in the Arctic Ocean, Norwegian Sea, or in the Labrador Sea. In this study, we could establish the LOs of *Sphaeropyle robusta* (1,500 ka, 161.9 m CCSFB at the median depth), *Eucyrtidium matuyamaii* (1,250 ka, 143.3 m), *Stylatractus universus* (450 ka, 74.9 m), *Axoprunum acqilonium* (350 ka, 61.5 m) and *Amphimelissa setosa* (77 ka, 25.0 m), and acme of *Lychnocanoma sakaii* (61 ka, 18.81 m). On the other hand, the FO of *Amphimelissa setosa* could be established for the first time in the northeastern Pacific between the LO of *Eucyrtidium matuyamaii* and the base of Jaramillo magnetic normal polarity epoch (1,072 ka).

キーワード: 第四期, 放散虫, 生層序

Keywords: Quaternary, Radiolarians, Biostratigraphy

Last glacial to deglacial biotic changes on the Great Barrier Reef from offshore boreholes

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IODP Expedition 325 drilled 34 boreholes into submerged reef structures along the shelf edge of the Great Barrier Reef (GBR). The boreholes were drilled between 42 and 167 mbsl at 17 sites along four transects at three geographic locations (Hydrographers Passage, Noggin Pass, and Ribbon Reef). The last glacial to deglacial reef sequence (~8 ka to ~27 ka) varies in thickness from ~5.5 m to ~34 m and consists primarily of corallgal boundstone with various proportions of microbialite. We use a detailed chronostratigraphic scheme based on numerous C14 and U-Th ages to discuss the evolution of the corallgal communities since the last glaciation. Exp. 325 cores show that different phases of sea level change promoted different shallow reef-building coral species at the study sites. The onset of the deglacial (16-19 ka) is characterized by a peak abundance of *Seriatopora* and *Tubipora* whereas the following rapid sea level rise (<16 ka) is marked by the dominance of massive *Isopora* and *Acropora* with medium- to robust-size branches. The shift in composition of coral communities around 16 ka coincides with the flooding of a pre-LGM MIS2 reef terrace, an event which had a major influence on reef growth and reef composition. We discuss the impact of this event on corallgal communities in the GBR and its significance for Quaternary reef evolution in general.

キーワード: IODP Expedition 325, Great Barrier Reef, Corallgal assemblages, Sea level changes, Glacial, Deglacial
Keywords: IODP Expedition 325, Great Barrier Reef, Corallgal assemblages, Sea level changes, Glacial, Deglacial

IODP 第 350 次航海伊豆背弧掘削で得られた火山岩化学組成の予察的結果 Geochemical variation of Izu rear-arc volcanic rocks at drill Site U1437: Preliminary results from IODP Expedition 350

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The Izu-Bonin-Mariana (IBM) arc is a good place to understand oceanic arc evolution. Crustal composition of the Izu segment of the arc differs beneath the arc-front and rear-arc (e.g. in terms of K, LREEs) (e.g. Hochstaedter et al., 2001; Ishizuka et al., 2003; Tamura et al., 2007). However, the magmatic history of the Izu rear-arc has not been well studied because Oligocene and Eocene Izu rear-arc lavas and volcanoclastics produced before the opening of the Shikoku basin have not been recovered by dredging or ROV sampling. Site U1437, drilled during IODP Expedition 350, is the first drill site in the Izu rear-arc and aimed to recover a record of volcanism in the rear arc from the present day to the Paleogene. This study will present preliminary major element (measured by X-ray fluorescence, XRF), trace element (measured by XRF and inductively coupled plasma-mass spectrometry, ICP-MS) and isotope ratios such as Sr, Nd, Pb and Hf (measured by ICP-MS and thermal ionization mass spectrometry, TIMS) to examine the geochemical signature of the recovered material and whether it can be related to the present day rear-arc or arc-front.

Site U1437 is located in a basin between the Manji and Enpo rear-arc seamount chains, about 90 km west of Myojinsho volcano on the Izu arc-front. Drilling reached 1806.5 meters below seafloor (mbsf), and the recovered rocks were divided into seven lithostratigraphic units and one igneous unit (a rhyolite intrusion). Lithostratigraphic Units I to V (0-9 Ma) dominantly consist of tuffaceous mud/mudstone. Below 1320 mbsf, Units VI and VII (older than 9 Ma) are composed chiefly of volcanoclastic layers, including coarser (>2 cm) volcanic clasts that are possibly derived from more proximal sources (Tamura et al., 2015).

Initially we have analyzed the major and trace element compositions of the volcanic clasts from Units VI and VII. Those show a wide range of compositions, from basalt to rhyolite, but are mainly intermediate (average $\text{SiO}_2 = 54.1$ wt%). The K_2O contents of the basalt to andesite clasts within the volcanoclastics are <0.9 wt%, with the exception of one clast, and their Zr/Y are <3.2 (average = 2.4), with the exception of two clasts. These characteristics are within the range of both the present day Izu arc-front and rear-arc. The present rear-arc type lavas are strongly enriched in LREEs, whereas the arc-front type are depleted. However, the chondrite normalized REE patterns of the clasts are flat ($\text{La/Yb} \sim 1.0$) or show slight depletions in LREEs relative to HREEs, so it is not clear if these proximal clasts are similar to the current arc-front or rear-arc. The deepest clasts that have been analyzed (from 1797.26 and 1798.57 mbsf) are basaltic andesites and have relatively high Zr/Y (3.5 and 4.1, respectively), similar to the present day rear-arc. However, their K_2O contents (0.89 and 0.35 wt%, respectively) and flat REE patterns are not.

The wide range of clast compositions make it difficult to distinguish whether the clasts from the deeper part of Site U1437 are derived from the present day Izu arc-front or rear-arc and whether or not this geochemical distinction existed when this material was erupted on the basis of major and trace elements alone. Analyses from additional samples and the isotope compositions of the clasts may be more diagnostic.

海底掘削試料中のクロミタイトに記録されている高温変成作用について High temperature metamorphism recorded on chromitite samples in drilling cores from ocean floor

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ODP、IODPにおける海洋地殻および蛇紋岩掘削では、下部地殻下部?モホ遷移帯に相当すると思われるはんれい岩や蛇紋岩化かんらん岩、さらにはポディフォーム型クロミタイトなどが採取されている (ODP Leg 209, IODP Exps. 304/305, 345)。それらの試料の一部は、著しく変質しており、変はんれい岩や蛇紋岩になっている。一見、非変質と思われる高温角閃石や、クロムスピネルなども、詳細に観察すると、緑色岩相?角閃岩相当の高温変成作用を受けて (Alt et al., 2003; Abe, 2011 など)。とくに、低温で変質に比較的強いと考えられているクロムスピネルの高温変成作用中の変化については、オフィオライトやコマチアイト試料についての研究例はあるが、海底試料においては少なく、近年の海洋科学掘削の大きな成果の一つであろう。

本発表では、ODP Leg 209 および IODP Exp. 345 の成果を踏まえ、低速拡大および高速拡大プレートにおいて、下部地殻?最上部マントル付近の深さまで熱水が循環していた可能性を検討したい。

キーワード: クロミタイト, IODP Exp. 345, 高温変成, モホ遷移帯, 海洋地殻, ODP Leg 209

Keywords: chromitite, IODP Exp. 345, high temperature metamorphism, Moho transition zone, oceanic crust, ODP Leg 209

ハードロック掘削での泥水検層とその意義 Mud logging in hard rock drilling

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Mud logging in a riser drilling operation has been powerful tool in the scientific drilling. Since fast and safe drilling are minimum requirements in the deep drilling operation, it is generally difficult that continuous coring is carried out to obtain geological sample (rocks and fluid). Therefore, cuttings survey and mud gas monitoring in mud logging are essentially important in the riser drilling for scientific research. Some hard rock drilling operations by using the Chikyu have been planned (e.g., IBM, MoHole). Since continuous coring in the hard rock drilling is technically more difficult as compared with the drilling for sedimentary rocks and slow rate of penetration results in consuming much of operation time, the cuttings survey is a unique approach for lithological characterization in the hard rock drilling. In addition, fluid sampling from hard rock core is also difficult, even if core sample is obtained. Thus, the mud logging is especially important for the hard rock drilling, not only minimizing operation time but also maximizing scientific result. In this presentation, we will introduce current technology of advanced mud logging and discuss on potential of the mud logging for the hard rock drilling.

キーワード: 泥水検層, 大深部掘削, ハードロック掘削, ライザー掘削, マッドガスモニタリング, カッティングス
Keywords: Mud logging, Deep drilling, Hard rock drilling, Riser drilling, Mud gas monitoring, Cuttings

IODP Expedition 344 コスタリカ沖の堆積物物性と間隙水圧 Distribution of physical properties and pore pressure of sediments off Costa Rica: IODP Expedition 344

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Evolution of physical properties in subduction zone is a key to understand lithification processes, location of decollement, stress distribution. In this study, we examined the physical properties of sediments using on-board data and laboratory experimental data on sediments obtained off Costa Rica margin to understand the distribution of compaction states.

Target sites are in the Integrate Ocean Drilling Program (IODP) Expedition 344 off Costa Rica, including reference sites (U1381 and U1414), frontal prism site (U1412), mid-slope site (U1380) and upper-slope site (U1413).

Laboratory experiments for velocity and porosity measurements were conducted with variation of effective pressure.

Porosity ranges from about 80% to about 53% during experiments. P-wave velocity ranges from about 1.4 to about 1.7 km/s. S-wave velocity ranges from about 0.75 to 0.93 km/s. V_p/V_s ranges from about 1.73 to 2.04. bulk modulus ranges 1.7 to 2.7. shear modulus ranges from about 0.8 to 1.4. V_p -porosity relationships from on-board data and from laboratory experiments are comparable nicely. This comparable trend in V_p -porosity relationship suggests that the relationship between porosity and effective pressure can be applied to most of sediments.

The porosity-effective pressure curves under isotropic condition were converted to the curves under uniaxial condition (Teeuw, 1971). Using the normal consolidation curves under isotropic and uniaxial stress conditions, we converted the on-board porosity to effective pressure and fluid pressure.

In bulk modulus-shear modulus graph, bulk modulus is not seen much change, but shear modulus there are variations.

For U1381 Unit I, hydrostatic fluid pressure was estimated as expected as a reference site.

For U1414 in another reference site, hydrostatic pressure was observed in Unit I, but lower fluid pressure than hydrostatic pressure was estimated in the upper part of Unit II. Below that, the pore pressure returned along hydrostatic pressure. This boundary can be weakened by higher fluid pressure below the boundary, suggesting that this boundary is likely a precursor of decollement.

For Unit 1412 in frontal prism, pore fluid pressure is lower than hydrostatic pressure, suggesting that they have lower porosity possibly caused by tectonic stress.

For 1380 in mid-slope and U1413 in upper slope, very low fluid pressure is observed. Because there is almost no age difference at the boundary, the extremely low porosity can be caused by rapid sedimentation and erosion on the seafloor or tectonic stress enhanced-dehydration.

キーワード: 掘削, コスタリカ, 海底堆積物, 物性, 間隙水圧
Keywords: Drilling, IODP, Costa Rica, Expedition 344, Physical properties

南海付加体, 巨大分岐断層浅部コア試料に認められる変形構造: IODP Exp. 338 解析結果
Structures characterizing the megasplay fault across shallow slope sediments of the Nankai accretionary prism

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LWD measurements at Hole C0022A and coring at Hole C0022B during IODP Expedition 338 confirm the early suggestion from seismic reflection imaging that a branch of the mega-splay fault crosses shallow slope sediments and may thus get close to the sea bottom. At C0022A, the evidence include (1) the presence of moderately to steeply dipping fractures between 86.6 and 105.5 mbsf and (2) the presence of a low-resistivity zone at the same interval, with a particularly low resistivity interval at 100-101 mbsf. At C0022B, the evidence include (1) three age reversals recognized between 76.48 and 84.48 mbsf, between 132.38 and 142.70 mbsf, and between 142.70 and 148.46 mbsf, (2) a bedding disturbed interval from 73.49 to 143.82 mbsf, (3) poor core recovery in the interval of 94.5-99.5 mbsf, suggesting highly fractured or disturbed material, and (4) the presence of three intervals of clay characterized by a composite planar fabric (338-C0022B-10T-5, 49-51 cm, 10T-CC, 19-20 cm, and 11H-1, 18-19 cm). By comparison with the nearby 3D seismic reflection image, the C0022A low-resistivity image at 100-101 mbsf could correspond to the megasplay fault core zone where displacement is supposed to be the largest. The sudden drop in core recovery at this interval indicates that coring at Site C0022 likely missed the megasplay fault core zone. Conversely, coring likely sampled secondary fault zones characterizing the damage zone of the megasplay fault branch at Site C0022. Post-cruise investigations aim at examining all structures and microstructures associated with this supposed damage zone.

Based on CT scan images, seven intervals were selected from Core 10T (three from section 5, one from core catcher) and from Core 11T (three intervals). For each interval, a slab was cut, dried, epoxied and polished before being analysed by XRF scanner for compositional mapping. Polished thin sections were made from the most deformed-looking parts of the slabs.

XRF scanning analysis brings two main results: At least three gently dipping planar surfaces outlined by iron sulphide (most likely pyrite) cross the cores. It is not clear whether these surfaces are faults or not but, in one case (11T-1, 72-83 cm), the surface separates clays with different Ca contents, suggesting some offset. The presence of iron sulphide along the surfaces may be related to fluid flow having allowed recrystallization of this mineral species. Shipboard observation revealed three intervals characterized by weakly marked planar fabrics. Two of these intervals (338-C0022B-10T-5, 49-51 cm and 11H-1, 18-19 cm) are characterized by a depletion in Ca and Sr and an enrichment in K with respect to the surrounding sediments.

Lastly, preliminary optical microscope observation indicates that some incipient non-coaxial shear deformation (asymmetrical sand lenses and composite planar fabric) affected the intervals with planar fabrics. Put together, these results indicate that deformation so far recognized in C0022B cores is weak to moderate. This is not an unexpected result given (1) the young age of the sediments and (2) the fact that samples likely come from the damage zone a few meters and not from the core zone.

[Acknowledgements]

We thank the crew of D/V *Chikyū* and all drilling personnel who contributed to the overall success of Expedition 338. We also thank Kyuichi Kanagawa, Takehiro Hirose and Kentaro Hatakeda for constructive discussions and technical help. This research used samples and data provided by the Integrated Ocean Drilling Program (IODP). Funding for this post-expedition research was provided by CDEX, JAMSTEC.

IODP 第 338 次および第 348 次航海で採取された堆積物コアの有機地球化学的研究 Distribution and evolution of organic matters in deep seafloor sediments collected during IODP Exp.338 and 348

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Seafloor sediments are important as a significant reservoir of organic matter, especially organic carbon and nitrogen. Sedimentary organic matters are mainly supplied through a photosynthetic process of phytoplankton biomass and other metabolisms of zooplankton and matured during diagenesis (Lee *et al.*, 1988). Proteins, peptides, and amino acid monomers are the main components and account for 30 – 40% of the total nitrogen and 10 – 15% of the total organic carbon content of seafloor sediments (Burdige and Martens, 1988). Some studies revealed the distribution and concentration of organic matters including hydrolyzable amino acids in shallow seafloor area (e.g., Cowie and Hedges, 1992; Kawahata and Ishizuka, 1993). The recent Integrated Ocean Drilling Program (IODP) Nankai Trough Seismogenic Zone Experiment (NanTro SEIZE) Expedition 338 and 348 at Site C0002 drilled and cored successfully up to 3059 mbsf. In this study, concentrations of hydrolyzable amino acids and maturation stage of organic matters in the sediments collected during the expeditions were determined in order to evaluate the distribution and evolution of sedimentary organic matters during diagenesis in deep seafloor.

Sediment core samples collected at Site C0002 (202.1 – 2216.9 mbsf), C0021 (3.7 – 186.4 mbsf), and C0022 (1.2 – 411.4 mbsf) were dried and powdered manually with an agate mortar on shore. The type and maturity of sedimentary organic matters were determined using Rock – Eval pyrolysis method at Japan Petroleum Exploration CO., LTD.

A part of the sediments were hydrolyzed to extract the amino acids from the hydrolyzable peptides and proteins. 1.0 g of the dried sediment was reacted with 6 N HCl at 110 °C for 22 h. The amount of total hydrolyzable amino acids (THAA) in the treated sample solutions were measured by high performance liquid chromatograph using postcolumn ortho-phthalaldehyde derivation.

The concentrations of THAA in the core collected at Site C0002 vary between 819.9 – 177.1 nmol/g, and Gly was the most abundant amino acid followed by Asp, Ser, Ala, Val, and Phe. At Site C0021 and C0022, the concentrations of THAA were 4679.2 and 6729.7 nmol/g at surface, respectively, and decreased drastically with depth. The THAA carbons account for <1% of total organic carbon and nitrogen, indicating that most of the biogenic organic matters would be changed into kerogens.

The amounts of hydrocarbons generated through thermal cracking of non-volatile sedimentary organic matter (S_2) were 1.2 – 0.15 mg/g. The low S_2 values and TOC (1.2 – 0.3 %) indicate that most of kerogen in the cores is categorized as type III. The temperatures at which the maximum release of hydrocarbons from thermal cracking of kerogen occurs during pyrolysis (T_{max}) were 379 – 416 °C at the shallow area (1.2 – 91.7 mbsf), increased gradually with depth, and reached to 439 °C at 2216.9 mbsf. Rock – Eval data indicate that the maturation of kerogens could be progressed with depth in seafloor sediment.

キーワード: ロックエバル, ケロジェン, アミノ酸
Keywords: Rock Eval, Kerogen, Amino Acids

IODP 第348次航海で得られたカッティングス中の炭質物ビトリナイト反射率 Vitrinite reflectance of carbonaceous materials in cuttings retrieved during the IODP Expedition 348

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Integrated Ocean Drilling Program (IODP) Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) Expedition 348 took place from 13 September 2013 to 29 January 2014. During the Exp. 348, cuttings, core samples, mud gas, and logging data were collected from Holes C0002N and C0002P down to 3058.5 mbsf. Four lithologic units were identified at Site C0002 based on geological and geochemical characteristics of core and cuttings samples: Unit II (475-512.5 mbsf in Hole C0002M), Unit III (875.5-975.5 mbsf in Hole C0002N), Unit IV (975.5-1665.5 mbsf in Hole C0002N), and Unit V (1665.5-2325.5 mbsf in Hole C0002N, and 1965.5-3058.5 mbsf in Hole C0002P)(Tobin et al., 2015).

To evaluate whole thermal structure of the Site C0002, we performed vitrinite reflectance analysis for cuttings samples collected every 100 m of Holes C0002N and C0002P. Vitrinite reflectance (R_o) is an indicator to estimate maximum paleotemperature, which has been widely applied to reveal tectonic evolution of on-land accretionary complex (e.g. Underwood et al., 1992; Sakaguchi, 1996; Ohomori et al., 1997) and thermal anomalies along fault slip zones reflecting frictional heating due to seismic slip (e.g. Sakaguchi et al., 2007; Sakaguchi et al., 2011). This is the first study that applied vitrinite analyses systematically to the entire modern accretionary prisms.

In this presentation, we report preliminary results of vitrinite reflectance analysis. R_o values are 0.15 to 0.20 in Unit III (forearc basin strata), 0.20 to 0.27 in Unit IV (accretionary prism strata), and 0.20 to 0.45 in Unit V (hemipelagic sediment). In general, R_o values tend to be gradually and continuously increasing with depth. Estimated paleotemperatures of Unit IV and V are approximately 40 °C and 90 °C, respectively, which are consistent with estimated modern temperatures (Sugihara et al., 2014).

キーワード: ビトリナイト反射率, 炭質物, 最高被熱温度, 付加体

Keywords: vitrinite reflectance, carbonaceous matter, paleotemperature, accretionary prism

統合国際深海掘削計画第337次研究航海の非弾性ひずみ回復 (ASR) 測定結果 Preliminary results of anelastic strain recovery (ASR) measurements during IODP Expedition 337

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IODP (Integrated Ocean Drilling Program) による下北八戸沖石炭層生命圏掘削 (第337次研究航海, Exp337) は、青森県八戸市の沖合約80km、水深1,180mの地点 (C0020) において「ちきゅう」によるライザー掘削を行い、当時の海洋科学掘削史上の最深記録となる海底下深度2,466 mまで到達した。海底下深度1,276.5m~2,466mの範囲において、コア試料の採取を行った。本研究は、当該掘削のコア試料を用いて、地層の三次元応力情報を得る目的で、コア試料の非弾性ひずみ回復 (Anelastic strain recovery, ASR と略称) を「ちきゅう」船上で測定した。

コア試料が地下で負荷していた応力が掘削により解放された場合、岩石の弾性ひずみは瞬間的に解放され、その解放のプロセスは測定することができない。しかし、非弾性ひずみは徐々に回復するので、コア試料が船上に上がってからも、その一部を測定することが可能である。このコア試料の非弾性ひずみテンソルと解放された応力テンソルとの関連性を利用した応力測定法は、非弾性ひずみ回復法 (ASR 法) といい、IODP Exp315 と Exp316 においては海洋科学掘削の分野において初めて成功に適用された (Byrne et al., 2009; GRL, Vol.36, L23310)。

Exp337 においては、海底下深度1,370~2,448mの範囲から計7つのコア試料を採取して、6つのコア試料について良質な非弾性ひずみ回復の時間連続変化データを得ることができた。海底下深度2,448mから採取されたコア試料のASR測定は、海洋科学掘削計画では最深の適用例である。本研究ではASRの測定方法として、Byrne et al. (2009) と同様な方法・装置・実験手順で行った。また、非弾性ひずみ回復測定後のコア試料を用いて、古地磁気測定によるコアの定方位を行なった。その結果、浅部の5試料で測定した応力状態は、基本的に正断層型、すなわち、最大主応力の方向はほぼ鉛直方向であった。最深 (2,448 mbsf) のコア試料の非弾性ひずみ回復から得られた最大主応力は、約30°の傾斜ではあるが、概ね逆断層型の応力状態を呈した。一方、水平面内の二次応力状態で見れば、すべての深度の最大水平主応力の方向は、東南東-西北西から東北東-西南西までの範囲に分布しており、平均的に東西方向であった。

謝辞：本研究で使用したコア試料はIODPの提供によるものである。また、船上での実施についてはExp337 Scientists, 「ちきゅう」の掘削オペレーションチーム、ラボのテクニシャンの協力を得たので、ここに深謝の意を申し上げる。

キーワード: 応力, 非弾性ひずみ回復法, IODP, Exp 337
Keywords: Stress, ASR, IODP, Exp 337

Stress State in the Tip of Ilan Plain and Its Applications for Taiwan Geothermal Plan Stress State in the Tip of Ilan Plain and Its Applications for Taiwan Geothermal Plan

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Understanding the relationship between in-situ stress and fluid-conduits is one of the most important keys for developing the enhanced geothermal system. At the same time, understanding this relationship also provide insights into evaluating the well locations and drilling direction.

The Ilan Plain of northeastern Taiwan is located between the Hsuehshan Range and Backbone Range and is influenced by the compression of mountain building between the Eurasian and Philippine Sea Plates and the back-arc extension of Okinawa Trough simultaneously. As a result, the 3D stress field is complicated and the attitude and spatial distribution of fluid conduits is not clear. To develop the technology of the enhanced geothermal system, this study focused on the evaluation of in-situ stress state on multiple scales.

Stress inversion of regional focal mechanism suggests that the stress state varies dramatically in the region and it is strike-slip faulting stress regime with NNE-SSW compression in the tip of Ilan Plain. The paleostress inversion results from the southern foothills show that the stress pattern of strike-slip faulting and normal faulting regime took place repeatedly and horizontal minimum stress orientation switched between N-S and W-E orientation. Analysis of anelastic strain recovery experiments on the retrieved cores of 720-920m indicates that a strike-slip faulting stress regime with NNW compression and NEE tension. Several hydraulic fracturing tests were conducted in the interval of 750-765m. The shut-in pressure is determined as 13.57MPa and reopening pressure is estimated as 12.66MPa. Diameter Core Deformation Analysis and rock mechanics experiments are also conducted. Integration of different stress assessments and rock strength data will provide insights to understanding the reasonable 3D in-situ stress in the tip of Ilan plain and further help the development of enhanced geothermal system.

キーワード: in-situ stress, enhanced geothermal system, Taiwan, Ilan Plain, hydraulic fracturing, ASR
Keywords: in-situ stress, enhanced geothermal system, Taiwan, Ilan Plain, hydraulic fracturing, ASR

新型 XRF コアスキャナーの性能と海洋コア研究への応用 Introduction of a new XRF core scanner and application of marine core science

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2014年, 高知大学海洋コア総合研究センターでは増設建て屋が完成し, 同8月に新型 XRF コアスキャナー (COX 社製) が導入された. 従来機器に比べ, 微小領域の元素マッピングが可能になり, 高分解能, 高解像度でコア試料が連続測定できる. 機器の特徴として, 以下が挙げられる.

- 1) 測定幅が小さい (200 μ m \times 8mm) ため, 微少な堆積構造 (ラミナやバンプなど) の元素分布を連続的に非破壊で, 高解像度の測定が可能である.
- 2) 従来機器に比べ管電流が高く, 検出器の感度が高いため, 1測点あたりに要する測定時間が短くても, 十分な強度が得られる.
- 3) XRF 測定と同時に, X線透過画像, カラーイメージが撮影でき, かつ, 3つのデータを統合して解析が可能である. 今後の海洋コア研究への応用が期待される.

キーワード: XRF コアスキャナー, ITRAX, 海洋コア
Keywords: XRF core scanner, ITRAX, marine core science