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

HGM02-01 会場:301A 時間:5 月 23 日 09:00-09:15

屋久島とイングランド南西部ダートムーアにおける起伏構造と地形の類似性
Similarities in relief structure and landforms between Yakushima Island in Japan and Dartmoor in southwest England

島津 弘 [1*]
SHIMAZU, Hiroshi[1*]

[1] 立正大学
[1]Rissho University

Relief structure and landforms was examined in two granitic mountains, Yakushima Island in south Japan and Dartmoor in southwest England. This study aims to compare these geomorphological characteristics between two mountains which have different geomorphological and geological settings.

Yakushima Island mainly consists of the Yakushima Granite dated at about 16Ma, which intruded into the Kumage formations of the Palaeogene. The highest peak is 1936 meters a.s.l. The area of the island is about 500 sq. kilometers. Dartmoor is underlain by a major batholith dated at 280 Ma which intruded into the sedimentary rocks of the Devonian and the Carboniferous. The area of Dartmoor is about 1000 sq. kilometers. The highest peak is 621meters a.s.l. Yakushima Island has been uplifted since the middle Pleistocene with high rate, whereas Dartmoor is in the tectonically stable environment.

In this study digital terrain model was used for analysis of the relief structure. The standard deviation of altitude in a 1 sq. kilometer unit is used for expressing relief. Each unit square includes 25 lattice points of a grid system with intervals of 250 meters. It is obtained from 1:50,000 scale topographic maps in Yakushima Island area and from a 50m-DTM made by Ordnance Survey Britain (OS) in Dartmoor area.

Although mean altitude and mean relief in Yakushima Island are higher than that in Dartmoor, shape of cross sections and pattern of altitudinal change in relief within each area is quite similar. The both mountains have a circle-like planform and a domelike profile. Relief increases with altitude in lower part of the both mountains. In the higher altitude area which is located in the central part of the two mountains relief decreases with altitude. This shows that relief structure of the both areas is characterized by the higher relief rims and the lower relief central parts. The cross sections of the dissected rivers show that the valleys with steep side slopes are found near the rims of the mountains and shallow valleys with gentle side slopes are found in the central part of the mountains. Although altitude, relief and inclination of slope are quite different between the two mountains, several similarities are found in relief structure and landforms, which could characterize the granitic mountains.

キーワード: 花崗岩山地, 起伏構造, 地形, 屋久島, ダートムーア
Keywords: granitic mountains, relief structure, landform, Yakushima Island, Dartmoor

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

HGM02-02 会場:301A 時間:5 月 23 日 09:15-09:30

インド洋の環礁におけるファロの形成過程
Development of faro topography in the Indian Ocean atoll

菅 浩伸[1*], 横山 祐典[2], 鈴木 淳[3], 中島洋典[4], Mahmood RIYAZ[5]
KAN, Hironobu[1*], YOKOYAMA, Yusuke[2], SUZUKI, Atsushi[3], Yosuke NAKASHIMA[4], Mahmood RIYAZ[5]

[1] 岡山大学, [2] 東大大気海洋研, [3] 産総研地質情報, [4] 有明高専, [5]Asian Institute of Technology, Thailand
[1]Okayama Univ., [2]Univ. Tokyo, AORI, [3]Geological Survey of Japan, AIST, [4]Ariake National College of Technology, [5]Asian Institute of Technology, Thailand

Faro (little ring-shaped reef, miniature atoll) is a circular reef, usually less than 3 or 4 km in diameter surrounding a shallow secondary lagoon of depths generally less than 20 m which is a characteristic feature in Maldivian coral reef. Because faros rise from the lagoon floor and edges of atolls, their mode of formation must differ from oceanic atolls whose foundations extend to great ocean depths (McLean 2011). However , there has been no substantive study of faros in Maldives.

Holocene reef structure and formation process are observed through an ocean-lagoon transect across the atoll-rim by observations of drilling cores and submarine exposure of reef interior at North Male Atoll, Maldives. We found a distinct faro formation during the Holocene reef development in Male Island which is the first report for substantive study on faro development.

The drilling penetrated 53.5m is conducted at the southeastern part of Male Island where former reef-crest lies under the present reclaimed land. Five reef units are defined from lithofacies of the core. In each reef unit, coral-algal bindstone accumulated on the top of loose reef sediments. The top unit is the post-glacial reef. The other four units are the Pleistocene reefs. The thickness of the post-glacial reef is around 8m where the coral-algal bindstone forms the uppermost 3.3m.

The post-glacial reef structure is also observed at a lagoon slope of the northeastern Male Reef from an exposure of reef interior down to 25m deep where a reef failure happened. The exposure composed of the post-glacial reef. The rigid reef structure is observed at the upper 2m of the lagoon-slope. The antecedent atoll-rim topography of the post-glacial reef is shallower at the rim and deeper beside the lagoon in the North Male Atoll.

AMS datings of the coral/algal samples show the development of the atoll-rim reef after 8,000 cal yBP. The upward reef growth in the early to middle Holocene is the same pace with the sea-level rise at the seaward edge and lagoon-ward edge which reached to the sea-level in the middle Holocene. The typical faro topography formed in this stage. The additional upward reef growth observed from drilling core at the seaward edge indicates the middle Holocene sea-level highstand in Maldives. Faro lagoon is buried by loose reef sediments after the middle Holocene.

Keywords: atoll, faro reef, coral reef, drilling core, Holocene, Maldives

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

HGM02-03 会場:301A 時間:5 月 23 日 09:30-09:45

ベトナム北部，紅河デルタの自然堤防形成と遺跡分布
Natural levees and human settlement in the Song Hong (Red River) delta,Northern Vietnam

船引 彩子 [1*], 斎藤 文紀 [2], VU Van Phai[3], NGUYEN Hieu[3], 春山 成子 [4]
FUNABIKI, Ayako[1*], SAITO, Yoshiki[2], VU Van Phai[3], NGUYEN Hieu[3], HARUYAMA, Shigeko[4]

[1] 日本大学文理学部, [2] 産業技術総合研究所　地質情報研究部門, [3] ハノイ理科大学, [4] 三重大学大学院生物資源学科
[1]College of Humanities and Sciences, Nihon University, [2]Geological Survey of Japan, AIST, [3]Hanoi University of Science, Vietnam National University, [4]Mie University, Graduate School of Bio resources

The Song Hong (Red River) delta, northern Vietnam, is characterized by huge natural levees in an area of the delta plain known as the West Floodplain where fluvial sedimentation predominates. The natural levees along the Day River, a major distributary of the Song Hong, are larger than those of the main course of the Song Hong. The Day River levees are 3?8 km wide and rise 3?5 m above the adjacent backswamps and have played an important role in human settlements since the late Metal age. We reconstructed the Holocene evolution of the Day River levees to determine their relationship to Holocene sea-level change, delta progradation, and the distribution of archaeological sites on the delta plain. During the early Holocene, the accumulation of sediment discharged by the Song Hong enhanced both aggradation of the levees and river mouth progradation within the drowned valley of the Song Hong. Radiocarbon dates from cores, trench exposures, and archaeological sites record a dramatic slowing of aggradation when sea level stabilized during 6?4 cal kyr BP (the Holocene sea-level highstand). As sea level fell to the present level during 4?0 cal kyr BP, the river mouth prograded rapidly toward the Gulf of Bac Bo (Gulf of Tonkin) and the river channels extended seaward. In the West Floodplain, lateral accretion overtook vertical accretion to generate the present longitudinal profiles of the Song Hong and Day rivers. During this period, human settlements spread across the backswamp and Holocene terrace area, lagging around 2 kyr behind the shoreline migration.

キーワード: 堆積速度, 考古遺跡, デルタ, 自然堤防, 海水準変動
Keywords: accumulation rate, archaeological sites, delta, natural levees, sea-level change

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

HGM02-04 会場:301A 時間:5 月 23 日 09:45-10:00

モンゴル北部フデル泥炭地における完新世の環境変動
HOLOCENE ENVIRONMENTAL CHANGES IN KHUDER PEATLAND, NORTHERN MONGOLIA

鹿島 薫 [1*], 福本 侑 [1], Orkhonselenge A.[2], Ulgiichimeg Ganzorig[2]
KASHIMA, Kaoru[1*], FUKUMOTO, Yu[1], ORKHONSELENGE, A.[2], Ulgiichimeg Ganzorig[2]

[1] 九州大学大学院理学研究院, [2] モンゴル科学院地理学研究所
[1]Faculty of Sciences, Kyushu University, [2]Institute of Geography, Mongolian Academy of Sciences

Holocene paleoenvironment in Khuder peat bog, the northern Mongolia was reconstructed by diatom and pollen analyses on peat boring samples. Diatom records of two boring cores showed a general chronology of peat land development from stream environments, marsh and then to the present acidic peat bog established as early as in the mid Holocene. Pollen and diatom records revealed Mid-Holocene drought from 6,000 to 3,000 cal yr BP and its periodic extent was correlative with other studies in Mongolia and the southern Siberia.

Abrupt changes of water environment and vegetation observed are associated with global climatic changes such as the Bond events occurred in North Atlantic Ocean. Cooler period of Little Ice Age and the warmer period of Medieval Warm Period were also remarkably manifested respectively as dry and wetter spells implying a strong connection of climate changes around the Northern hemisphere. However, climate changes contradictive with the results of other studies were also often observed, so the geographical features, pedology and orography should be the key control factors for the moisture balance of the area. We inferred that the observed climatic changes would be reflecting displacement of continental dry region as the study area is located in the transitional vegetation zones between Siberian taiga and Mongolian arid steppe.

キーワード: モンゴル北部, 完新世, 気候変動, 泥炭
Keywords: Northern Mongolia, Holocene, Climate change, Peat sediment

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

HGM02-05 会場:301A 時間:5 月 23 日 10:00-10:15

琵琶湖周辺における湖沼堆積物に記録された大洪水イベント
Disastrous flood events found in lacustrine sediments around Lake Biwa

糸野 妙子 [1*], 若狭 まどか [1], 柏谷 健二 [1]
ITONO, Taeko[1*], WAKASA Madoka[1], KASHIWAYA, Kenji[1]

[1] 金沢大学
[1]Kanazawa University

Lacustrine sediments have high-resolution regional environmental records on lake and its surrounding catchments in addition to global information. Therefore they are of great use for reconstructing past hydro-environmental fluctuations and understanding lake-catchment processes. Lake-catchment systems with many instrumental stations are of great use for past environmental reconstruction in detail and process-understanding of the systems (e.g. Lake Biwa).

Here we discuss about hydro-environmental fluctuation in the instrumental observation period on the basis of physical properties of sediments. Some sediment core samples were obtained with 1-m sampler in Lake Biwa and Lake Yogo, central Japan.

Analytical results for the core sediments, obtained in Lake Biwa, show that disastrous flood events, Isewan Typhoon (1959) and Meiji heavy rainfall (1896), are clearly recorded in physical properties of sediments; density and mineral content are good proxies of rainfall intensity (100mm excess rainfall); and grain size distribution in lakes may be a function of rainfall intensity in the catchment and transporting distance from the river mouth. Additionally, we compare results of physical properties of sediments in Lake Biwa with those in Lake Yogo during the flood events in detail.

キーワード: 洪水イベント, 湖沼堆積物, 湖沼‐流域プロセス
Keywords: flood event, lacustrine sediment, lake-catchment process

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

HGM02-06 会場:301A 時間:5 月 23 日 10:15-10:30

Impact of volcanic activity on Late Holocene sedimentation pattern of a river-lake system in Hokkaido
Impact of volcanic activity on Late Holocene sedimentation pattern of a river-lake system in Hokkaido

Thomas Parkner[1*], Seji Yanai[2]
PARKNER, Thomas[1*], Seji Yanai[2]

[1]Graduate School of Life and Environmental Sciences, University of Tsukuba, [2]Ishikawa University
[1]Graduate School of Life and Environmental Sciences, University of Tsukuba, [2]Ishikawa University

Sediment production and sediment transfer through fluvial systems into oceans is very high on the Japanese Islands compared to other regions of the world, as most rivers in Japan are relatively short, show high gradients and are disturbed by human activity. In this study we reconstruct the sedimentation history of the floodplain of Bibi River and Lake Utonai to analyse the impact of volcanic activity on this river-lake system located in Southern Hokkaido. Bibi River is 17 km long and its catchment of 88 km2 consists of the Eastern slopes of the active volcanic complex Shikotsu-Tarumae. The flat, 4.1 km2-large floodplain formed 3000 years ago after the regression of the Pacific Ocean. Bibi River drains into the North-Eastern section of Lake Utonai, which has a total area of 2.3km2 with a maximum depth of 1m. During the last 3,000 years the catchment has been continually used for agriculture and was systematically developed since the beginning of the last century.

To analyze the volcanic impact 6 cores on the floodplain and 7 cores in the lake were taken. To distinguish between air-fall sediment and fluvially transported sediment the cores were sliced into 3cm or 5cm thick samples. For the 620 samples the parameters dry density and ignition loss mean grain size, sorting, skewness and kurtosis were determined.

Three air-fall deposits were identified as Ta-a (1736 A.D.), Ta-b (1667 A.D.), and Ta-c (3000 yBP) which each deposited 1.4 Mio t to 1.8 Mio t sediment on the floodplain and in the lake. Layer thickness on the floodplain depended on eruption direction. For the lake deposits, lake currents seem to focus of the air-fall tephra during flotation. About 0.6 Mio t of fluvial sediment was deposited on the floodplain during the last 3,000 years. During the period 1667 A.D. ? 3,000 yBP an average of 0.070t/ha/y were deposited with an increasing sedimentation rates downstream. During 1736 A.D. and 1667 A.D. an average of 1.5t/ha/y accumulated on the floodplain with highest rates in the middle reach. Sedimentation rates decreased to 0.69t/ha/y during the recent period (2006 A.D. - 1736 A.D.), but showed very high values near road construction sites of the last century. Lake deposition reached 0.05t/ha/y (present - 1736 A.D.), 0.47t/ha/y (1736 A.D. to 1667 A.D) and 0.04t/ha/y (1667 A.D. to 3,000 yBP) with highest sedimentation rates in the northern section due to sediment focusing.

Results suggest that the sediment stored on the floodplain and in the lake is dominated by air-fall tephra (4.6 Mio t out of 5.2 Mio t). Even though the catchment was disturbed by human activity only very little fluvial sediment was deposited on the floodplain or in the lake after the Ta-a eruption. This indicates that mid-Holocene coastal plains can significantly reduce sediment transfer through fluvial systems into oceans by buffering sediment on floodplains and lakes. This finding might not only apply to the study area, but also to other volcanically disturbed catchments with mid-Holocene coastal plains. In such systems the impact of volcanic activity may dominate over human and climate impact.

キーワード: volcanic impact, river, lake, Late Holocene
Keywords: volcanic impact, river, lake, Late Holocene

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

HGM02-07 会場:301A 時間:5 月 23 日 10:45-11:00

セメント系材料の混入による土壌中自然含有重金属類の溶出可能性に関する研究
Leachability of heavy metals and arsenic in soils due to contamination of disposal cement building materials

北口 竜太 [1], 八戸 昭一 [2], 小口 千明 [3*]
KITAGUCHI, Ryuta[1], HACHINOHE, Shoichi[2], OGUCHI, Chiaki T.[3*]

[1] 埼大・工・建設, [2] 埼玉県環境科学国際センター, [3] 埼大・地圏セ
[1]Dept. Civil & Env. Eng., Saitama Univ., [2]CESS, [3]GRIS, Saitama Univ.

日本の国土は多様な地質からなり、火山や温泉が多数分布している。そのため多くの地層、岩石がしばしば重金属を含んでいる。埼玉県荒川低地においても、堆積物中に砒素や重金属が多く含まれる層が存在することが指摘されている。これらは海成層であることが多く、微小の貝殻などを含むことから、他の層準よりも pH が高くなることが多い。このことから、pH の高低と、砒素などの重金属の溶出量の間には何らかの関係があることが推測される。また今日では、コンクリートは、ビルや住宅、橋梁、ダムなど多くの構造物に用いられており、我々の生活に欠かせない材料である。しかし一方で日々多くのコンクリート構造物が老朽化、もしくは用途がなくなった等の理由で撤去されている。その際に微量ではあるが、構造物撤去後の跡地にコンクリートが残留してしまう。その結果として跡地周辺の pH が上昇し、土壌に含まれていた重金属が溶出し、土壌汚染を招く可能性がある。そこで、pH の上昇と、重金属の溶出の間の関係性を明らかにすることを目的に実験を行った。

本研究では骨材の影響を排除するため、コンクリートではなくモルタルを使用することで簡潔化した。土壌試料に粉砕したモルタルを、土壌：モルタル比を変えて混入することで抽出溶媒の pH を調節しながら溶出試験を行い、溶出した重金属等の種類と濃度を測定した。用いたモルタルは早強ポルトランドセメントモルタルである。このモルタルを粉砕してふるいにかけ、4.75?1.18 mm, 1.18?0.5 mm, 0.5?0.3 mm, 0.3 mm 未満の 4 段階の粒径にわけた。また、土壌サンプルは埼玉県環境科学国際センター敷地内で掘削されたボーリング試料を風乾後に粉砕し、2 mm のふるいを通過したものを使用した。溶出試験は簡略化のためにサンプル 3 g、純水 30 ml で行い、土壌へのモルタルの混入率は 0 %, 1 %, 10 %, 20 %, 50 %, 100 %の 5 段階とした。

重金属等の溶出量と、pH の関係を調べたところ、アルミニウムは中性付近では Al はあまり溶出しておらず、液性が酸性側、アルカリ性側に変化すると溶出量は増加している。Fe の溶出には pH の影響はあまり見られない。グラフ左側に分布している数点では比較的多くの Fe が検出されていることから、液性が酸性側によると Fe の溶出量が増加する可能性もある。Mn の溶出量は、Fe のものと比較的近い形の分布となった。Mn においても、液性が酸性側となった時に溶出量が増加する可能性が高い。Se については、pH が 6.5 を超えた辺りからアルカリ性側に行くに従って、溶出量が増加している。pH が 11.22 のサンプルから最も多くの Se が溶出している。それよりも pH が高いサンプルでは溶出量が若干少ない。このことから pH 11 辺りで溶出量はピークを迎え、それ以上の pH だと溶出量は減少する可能性がある。砒素については、pH 7 の辺りを最小値とし、下に凸の 2 次曲線のような分布となった。As に関しても pH が 11 を超えた辺りから溶出量が減少している。対象としたほとんどの金属において、pH と溶出量の間に関係があることが確認された。また、多くの金属は液性が中性であれば比較的溶出量は少ない。したがって、土壌の pH を中性付近に中和することで、モルタル、コンクリートが混入しても土壌中の金属の溶出を抑えることが可能であると考えられる。土壌汚染対策法で溶出量に基準が定められている重金属（Se、As：0.01 mg/l）に関しては、基準値を超える溶出は見られなかった。しかし、溶出量は、土壌の金属含有量に依存するため、これらの物質を豊富に含む土壌の場合はモルタル、コンクリートの混入により基準値を超えて溶出する可能性がある。

キーワード: 溶出, 重金属, ヒ素, 土壌, セメント
Keywords: leaching, heavy metals, arsenic, soil, cement

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

HGM02-08 会場:301A 時間:5 月 23 日 11:00-11:15

ナノライムや樹脂を用いた岩石の強化実験 -大谷石、琉球石灰岩、安山岩を中心に-
Experimental study of rock strengthening tuff, limestone, and andesite by using nanolime and other consolidants

宋 苑瑞[1*], アンドラス　モルゴス[2]
SONG, Wonsuh[1*], MORGOS, Andras[2]

[1] 筑波大学陸域環境研究センター, [2] 東京芸術大学大学院美術研究科
[1]Terrestrial Environment Research Center, University of Tsukuba, [2]Graduate school of Conservation, Tokyo University of the Arts

This study is focussing to the efficiency and evaluation of up-to-date consolidants (a non-aquaeous collodial nanolime (Ca(OH)2) suspension, a well-known oligomeric tetraethoxysilane product (Wacker SILRESR BS OH 100), an extremely low viscous epoxy resin (Araldite 2020) and for cultural heritage the most frequently used thermoplastic acrylic resin (ParaloidTM B-72 or also called AcryloidTM B-72) which is known from its good durability, high transparency and non-yellowing film-properties for the consolidation of Oya-tuff. The consolidation effect of nanolime particles were also studied on Ryukyu-limestone and Indonesian basaltic andesite.

The actuality of this study is given by the fact, that degradation (corrosion) of the rocks is incredible speeded up in the last decades by the increased air-pollution e.g. acid rain etc. This makes the stone buildings, objects and sites much more vulnerable. The stone material weakens and looses its original binder to a considerable depth. Consecutively many stone historical constructions require consolidation, conservation and restoration in recent days.

The consolidants were tested by the measurement of tensile strength, Equotip surface hardness, p-wave velocity.

キーワード: 岩石強化, ナノライム, 樹脂, 凝灰岩, 石灰岩, 安山岩
Keywords: Rock strengthening, nanolime, resin, tuff, limestone, andesite

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

HGM02-09 会場:301A 時間:5 月 23 日 11:15-11:30

地表被覆状態の違いによる低標高山地斜面における冬季の斜面物質移動量の違い
Difference in surface-stone dislocation by ground cover on wind-beaten slopes in temperate low mountains in winter

瀬戸 真之 [1*], 田村 俊和 [2]
SETO, Masayuki[1*], TAMURA, Toshikazu[2]

[1] 埼玉大学地圏科学研究センター, [2] 立正大学地球環境科学部
[1]Geosphere research institute of Saitama University, [2]Rissho University

森林限界以下の低標高山地斜面では周氷河性物質移動が十分に起こりうるポテンシャルを持ちつつも，植生によって地表が覆われているために通常は周氷河性物質移動プロセスが活発に起こることは少ない．しかし，強風や人為の影響により植生が破壊されると季節的凍土が出現したり，周氷河性のマスムーブメントが卓越したりするようになり，いわゆる高山環境と良く似た景観を呈するようになる．福島県御霊櫃峠は猪苗代湖の東に位置し，峠に近い標高約 1000m の斜面は風衝砂礫地となっている．ここでの年平均気温は 7.3 ℃で，冬季には－ 10 ℃付近まで気温が低下する．この砂礫地は表面を扁平な角礫がオープンワークに覆い（　層），その下位には暗褐色砂壌土が堆積している（　B 層）．その下位はにぶい黄橙色～暗褐色砂壌土（　C）があって，凝灰質砂岩を覆っている．砂礫地縁辺の植生があるところでは　層を欠き，　B 層の直上に有機物に富む腐植質砂壌土が残っている（　A 層）．本研究ではこの調査地で気温，地温，地表面温度およびペンキライン法による地表物質移動の観測を 2006 年冬から 2009 年冬までの 4 期間実施した．2007 年冬は地表物質移動観測後に地表面を観察し，　層が厚い（すなわち礫が地表にある）C タイプと　層を欠き，　B 層の細粒土層が露出している F タイプとに区分した．以上の観測の結果，凍結融解が生じているのは地表面下数 cm のごく浅い部分（　B 層）であり，年によっては季節的凍結も見られた．また，2007 年における C タイプと F タイプの斜面物質の移動距離は平均値でそれぞれ 0.35m，0.52m であり，0.2m の差が見られた．このように C タイプよりも F タイプの方が冬季の物質移動距離が大きい傾向が見られた．この傾向と地温の観測結果から，季節的凍結や日周期の凍結融解サイクルが生じる　B 層が地表に露出している F タイプの方が物質移動が活発であると考えた．C タイプは　層（扁平礫）が地表を覆っているのに対して F タイプは　B 層の細粒物が地表に露出し，直接温度変化にさらされる．したがって，C タイプと F タイプの両タイプを比較すると F タイプの方が C タイプよりも凍結融解サイクルが生じ易いと言える．以上から御霊櫃峠では地表面付近の凍結融解が冬季における物質移動の駆動源となっており，これには　層の厚さ，すなわち地表被覆状態の違いが強く影響していると考えた．このように地表被覆状態や地表付近での凍結融解が冬季の物質移動に支配的役割を持つことは，凍結融解サイクルがごく浅い部分でのみ起こる低標高山地斜面の特徴であると言える．

キーワード: ソリフラクション, 地表物質, 低標高山地斜面
Keywords: Solifluction, Surface materials, Low altitude mountain slopes

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

HGM02-10 会場:301A 時間:5 月 23 日 11:30-11:45

華厳滝における崖面のレーザスキャン
Terrestrial laser scanning of cliff face at Kegon Falls

早川 裕弌 [1*]
HAYAKAWA, Yuichi S.[1*]

[1] 東京大学空間情報科学研究センター
[1]Center for Spatial Information Science

Mechanisms of bedrock erosion at waterfalls have been studied so far for several cases, but there remain some uncertainties in erosional processes with regard to detailed form of rocks composing a waterfall. In this study, detailed form of cliffs around Kegon Falls in Nikko, Japan is examined using a terrestrial laser scanner (TLS). Kegon Falls has a total hight of 97 m, with a vertical drop of surface water and outflows of underground water at the lower portion of the cliff. The form of cliffs around the waterfall was measured using a TLS (Topcon GLS-1500) from an observatory facing the waterfall, and the obtained point cloud was georeferenced using a GNSS-based position coordinates of measurement targets. The point cloud was then rotated in order to create a digital elevation model (DEM) on a vertical plane. Longitudinal and transverse profiles were then extracted from the vertical DEM. The stability of the collapsed portion in the cliff indicates that the collapse in 1986 could have likely occurred with crack propagation along joints within the former cliff. The stability analysis also suggests that catastrophic collapse of whole of the waterfall face seems to hardly occur, because the igneous rock composing the cliff is strong enough to keep its current overhanging shape. Actually smaller-scale collapses of the cliff face have occurred in recent years. Whereas, frequent occurrence of freeze-thaw weathering seems to be responsible for the formation of a depression at the bottom of the uppser cliff of lava. The load and tractive force by surface water flow (up to 100 t/s when flooding) may support faster removal of rock blocks behind the water drop. Multiple processes are thus responsible for the erosion of the cliff face of Kegon Falls.

キーワード: 滝, 侵食, 岩盤, 崖, 地上レーザスキャン
Keywords: waterfall, erosion, bedrock, cliff, terrestrial laser scanning

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

HGM02-11 会場:301A 時間:5 月 23 日 11:45-12:00

三浦半島の海岸における 1703 年元禄地震以前の地震性隆起運動の地形学的証拠
Geomorphic Evidence of Uplifting Associated with Old Kanto Earthquakes Before 1703 in a Coast of Miura Peninsula, Japan

金 幸隆 [1*], 熊木 洋太 [2], 佐竹 健治 [1]
KIM, Haeng Yoong[1*], KUMAKI, Yohta[2], SATAKE, Kenji[1]

[1]ERI, Univ. Tokyo, [2]Geography, Senshu Univ.
[1]ERI, Univ. Tokyo, [2]Geography, Senshu Univ.

We need to know the amount of the vertical crustal movement and the occurrence date for the Kanto earthquake prior to 1703, for better understanding the earthquake cycle, and thus to estimate the average recurrence time and the magnitude of earthquake for estimating the future earthquake hazard. So we sought the trace of the crustal movement along the coastal region in the southwestern Miura Peninsula. To identify the uplifts associated with recent great Kanto earthquakes, we made a high-density (50 cm mesh) digital elevations map by aerial measurements of the Light Detection and Ranging (LiDAR) in southwestern coast of the Peninsula. In addition, we analyzed air photos taken in 1946, 1963 and 1966.

As a result, five to six steps of marine terrace surface were observed between the Nobi 3 surface and the present coastline, including the 1923 and 1703 emerged terrace surfaces, in the alluvial valley. These terrace surfaces are edged in a small cliff of the height of 1-2 m. In addition, LiDAR data indicate flights of wave-cut-bench on rocky coast (8 m above MSL) in Jogashima, southernmost tip of Miura. These marine terrace surfaces may indicate additional evidence of the uplift associated with the Kanto earthquakes.

Compared the 1:25,000 of old topographic map made in 1921 by Land Survey Department and in 1966 by Geography Survey Institute, the regradation of the coastline is identified in the coast area of Miura. The coastline was shifted from the land side to the sea side, thus the zone between 1921 and 1966 coastlines was dried from the sea to the land. At the bay head of Koajiro, the sea was dried up approx. 300 m in the length. The lowest level of terrace surface which was identified from LiDAR Data and old topographic map have been formed by 1923.

キーワード: 関東地震, 履歴, 隆起量, 海成段丘面, 海岸線
Keywords: Pre-1703 Kanto Earthquake, Recurrence time, Amount of Uplift, Marine terrace sruface, Coastline

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

HGM02-P01 会場:コンベンションホール 時間:5 月 23 日 17:15-18:30

オーバル修道院で用いられている人工石材の風化に関する研究
Study in salt weathering of reconstituted stones used in the Orval Abbey, Belgium

グェン ティ ハイ デュン [1*], 藤巻 俊昭 [2], 小口 千明 [3]
NGUYEN, Thi Hai Duong[1*], FUJIMAKI, Toshiaki[2], OGUCHI, Chiaki T.[3]

[1] 埼大・工・建設, [2] 埼大・院, [3] 埼大・地圏セ
[1]Dept. Civil & Env. Eng., Saitama Univ., [2]Graduate School of Sci. & Eng., Saitama Univ., [3]GRIS, Saitama Univ.

人間は住環境をより良くするため、古来から様々な材料を試み、工夫を凝らしてきた。そのような材料の 1 つとして各種の岩石が使用され、多くの素晴らしい石造建造物が造られてきた。しかし、建設当初は美しい外観を呈す建造物も、時間と共に風化により、岩石表面が剥離したり変色したりしてしまう。このような風化を考慮する際には、岩石のもつ間隙構造や化学組成と、温度や水分状態などの周辺環境について調査されなければならない。近年、宗教施設の一般人への部分的開放で注目されているベルギー南部・ワロン地方のオーバル修道院においても、使用石材の塩類風化が深刻な問題となっている。既往の研究（大澤、2011；藤巻、2011）により、析出塩類は主としてテナルダイト（Na2SO4）であることが判明しているが、その起源について断言できるほどの証拠は持ち合わせていなかった。本研究では、同じ建造物を調査対象とし、使用されている石材が風化する原因について、フィールド調査と材料科学的調査の双方から明らかにすることを目的とする。

キーワード: 風化, 硫酸ナトリウム, テナルダイト, オーバル修道院, 人工石
Keywords: weathering, sodium sulpfhate, thenardite, Oval Abbey, reconstituted stone

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

HGM02-P02 会場:コンベンションホール 時間:5 月 23 日 17:15-18:30

建造物を構成する岩石の塩類風化に関する室内実験
Influence of environmental conditions and test method on sodium sulfate weathering of four Japanese building stones

Swe Yu[1*], 小口 千明 [1]
SWE, Yu[1*], OGUCHI, Chiaki T.[1]

[1] 埼玉大学地圏科学研究センター, [2] 埼玉大学地圏科学研究センター
[1]Geosphere Research Institute of Saitama University, [2]Geosphere Research Institute of Saitama University

Many standard and laboratory salt weathering tests have been elaborated to investigate the mechanisms of salt damage, which have threatened our priceless cultural heritage made of porous stones. The tests are also used to investigate the relative destructiveness of salts, and durability of different rocks for selecting proper ones for restoration works. Some results of these studies, however, have become debatable due to employing different test methods and environmental conditions. So far, comparative studies about test conditions are scarce. In addition, there are arguments about sodium sulfate, which is the most widely used salt in laboratory tests, as to which phase of the salt, i.e. thenardite or mirabilite, is responsible for the sodium sulfate damage. To solve these arguments, a series of laboratory experiments was performed by using two types of salt supply techniques: continuous partial immersion (CPI) and cyclic total immersion (CTI). Both tests were conducted under three different environmental conditions: (i) 20^{o}C and 60% RH for 24 h (CPI 1); (ii) 45^{o}C and 40% RH for 24 h (CPI 2); (iii) 45^{o}C and 30% RH for 12 h and 10^{o}C and 70% RH for 12 h (CPI 3); (iv) 3 h immersion at 20^{o}C, 19 h drying at 45^{o}C, and 2 h cooling at 20^{o}C (CTI 1); (v) 3 h immersion and 21 h drying at 45^{o}C (CTI 2); and (vi) 3 h immersion at 20^{o}C, 17 h drying at 105^{o}C, and 4 h cooling at 20^{o}C. CPI 2 and CTI 2 tests were designed to investigate the destructiveness of sheer thenardite. All tests were run for fifty 24-h cycles. Prismatic specimens (5 x 5 x 15 cm3) of four types of Japanese building stones, namely Oya Tuff, Ashino Tuff, Indian Sandstone, and Tago Sandstone were used. A range of hydromechanical properties were investigated. For salt supply, saturated sodium sulfate solution (at 20^{o}C) was used in all tests. It is observed that durability ranking of the rocks did not perfectly reflect their hydromechanical properties. Oya Tuff was consistently the least salt resistance in all of the tests, mirroring its properties. However, in contrary to their hydromechanical properties, Tago Sandstone, Ashino Tuff, and Indian Sandstone showed different durability against sodium sulfate in different tests, indicating the unreliability of rock properties in predicting salt susceptibility. Differing to what have been perceived, at the same upper-limit temperature, CPI tests were found generally more destructive than CTI tests, except for the extraordinarily aggressive CTI 3 test driven by a very high drying temperature. The results of CPI 2 and CTI 2 tests revealed that thenardite alone could cause significant damage, although the induced damage was smaller than that of mirabilite-involved tests such as CTI 1, CTI 3, and CPI 3. This suggests that in addition to the immense power of mirabilite attack, the contribution of thenardite in rock decay during drying cannot be discounted in CTI tests. In fact, it was the cyclic conversion of thenardite-mirabilite mechanism, which causes severe damage, no matter what salt supply technique is employed. Moreover, the two salt supply techniques produced markedly different damage patterns: CTI tests induced granular disintegration, spalling, fragmentation, or crumbling, whereas CPI tests mainly produced scaling, cracking, or efflorescing depending on environmental conditions and rock properties. The reason behind this is the continuous accumulation of salts deep inside the CPI-specimens, which produced severe internal cracking and thick scaling, in contrast to the cyclic disintegration of outermost surfaces of CTI-specimens, which did not favor the salt accumulation.

キーワード: 塩類風化, 継続的部分浸漬, 全体浸漬サイクル, 硝石, 含水硫酸ナトリウム
Keywords: salt weathering, continuous partial immersion, cyclic total immersion, thenardite, mirabilite

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

HGM02-P03 会場:コンベンションホール 時間:5 月 23 日 17:15-18:30

石材の鉱物学的特性と色彩評価に関する研究
Mineralogical characterization of a stone by using colorimetry

中山 泰志 [1*], 小口 千明 [2]
NAKAYAMA, Taishi[1*], OGUCHI, Chiaki T.[2]

[1] 埼大・工・建設, [2] 埼大・地圏セ
[1]GRIS, [2]GRIS,Saitama Univ.

“ 色 ”は風化を認識する際の手掛かりとして、破壊などと並び基本的な情報の一つである。岩石の色は、主として各構成鉱物の色と量比で決定されると考えられる。例えば、Nagano and Nakashima,(1989) は、花崗岩の風化の研究において、酸化鉄鉱物の量比と色の関係の検量線を作成し、分光測色から酸化鉄鉱物の種類や量比を識別できることを示した。このような手法は、化学分析では識別が難しい鉱物、特に粉末 X 線回析や顕微鏡下でのポイントカウンティングが困難な少量の鉱物の種類や量比を知るうえで極めて重要であると考えられる。

風化認識の際に鉱物種の特定というのはとても重要な情報である。一般的に鉱物種を特定する際に取られる手法はX線粉末回析（XRD）であるが、この手法は実験室に試料を持ち帰り分析する必要があるため、試料を持ち帰ることが困難な重要文化材や石碑などの測定には向いていない。そこで本研究では、近年フィールドワークにおいて色の定量的な記載や風化認定などに用いられている分光測色計を利用し、そこで得られる分光反射スペクトルから鉱物種を特定する手法の可能性について検討する。

キーワード: 鉱物種, 分光反射率スペクトル, 色測定
Keywords: mineral species, visible-reflectance spectrum, color measurement

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

HGM02-P04 会場:コンベンションホール 時間:5 月 23 日 17:15-18:30

秋吉台における石灰岩の溶解速度：野外風化実験と水文観測に基づく推定
Dissolution rate of limestone at a doline in the Akiyoshidai karst plateau

秋山 沙苗 [2], 八反地 剛 [1*], 松四 雄騎 [3], 松倉 公憲 [4]
Sanae Akiyama[2], HATTANJI, Tsuyoshi[1*], MATSUSHI, Yuki[3], Yukinori Matsukura[4]

[1] 筑波大学生命環境系, [2] 筑波大学大学院生命環境科学研究科, [3] 京都大学防災研究所, [4] 筑波大学
[1]Faculty of Life and Environmental Sciences, University of Tsukuba, [2]Graduate School of Life and Environmental Sciences, University of Tsukuba, [3]Disaster Prevention Research Institute, Kyoto University, [4]University of Tsukuba

カルスト地域に見られる凹地（ドリーネ）の形成過程を議論する上で，ドリーネ内における石灰岩溶解速度の空間分布を明らかにすることは重要である．宇宙線生成核種年代測定法に基づき，長期間の平均値な溶解速度を求めた研究もあるが，今後の地形発達を予測する上では現在の環境における溶解速度を明らかにすることも重要である．そこで本研究では，山口県の秋吉台石灰岩台地にある円形ドリーネ（直径 150 m，深さ 20 m）を対象とし，現在のドリーネ地下の水文環境を明らかにするとともに，野外風化実験を行い石灰岩の溶解速度の規定要因を明らかにした．さらにこれらの結果を組み合わせ，ドリーネの現在の環境における石灰岩の溶解速度と，今後のドリーネ地形の発達について検討した．

ドリーネの地下構造を調べるため，比抵抗映像法を用いた 2 次元電気探査と簡易貫入試験を実施した．比抵抗値の空間分布と簡易貫入試験による基盤岩－土壌境界の結果を比較すると，比抵抗値 300 Ω m 付近に存在する値の急遷部が基盤岩－土壌境界とほぼ一致した．基盤岩－土壌境界面は斜面上方ほど浅く，ドリーネ底部では深い傾向にあった．基盤岩の形状は滑らかではなく，一部が地表面に露岩として現れている場所もあった．また，基盤岩－土壌境界の上部に沿うように，低比抵抗値（～100 Ω m）の層が存在した．この層は，地表面が非常に乾燥する時期にも存在していた．検土杖により採取した土壌の水分量測定によると，比抵抗値が 120 Ω m を示す付近では土壌水分飽和度 90%（S3, 深さ 70 cm），190 Ω m を示す付近では土壌水分飽和度が 83%～87%（S1, 深さ 50～100 cm）であった．地下深部まで土壌粒子の構成や密度が同じだと仮定すると，基盤岩－土壌境界面の上部に存在する低比抵抗部は，土壌水分の飽和度がほぼ 100 %と推定される．

野外風化実験では，ドリーネの斜面上部（S1），斜面中部（S3），斜面下部（S5)，底部（S6）の 4 地点の土壌中（深さ 50 cm，S1 と S5 には更に深さ 15 cm）に合計 6 個のタブレット（秋吉台石灰岩，阿武隈石灰岩の 2 種類：直径 3.5 cm，厚さ約 1 cm）を設置した．期間は 2009 年 4 月～11 月（218 日間），2010 年 3 月～2011 年 1 月（307 日間），3 月～11 月（243 日間）である．同時に実験地点において土壌水分と地温を連続観測し，二酸化炭素濃度と土壌水の水質は定期的に測定した．野外風化実験の結果，秋吉台石灰岩について S1，S3 の深さ 50 cm では溶解速度が 1.6～3.3%/y と大きく，斜面下部で 0.11～0.55%/y と小さかった．ドリーネ底部では 0.52～0.88%/y と中間の値であった．これら場所や年度による溶解速度の違いについて，水文観測の結果を説明変数とし回帰分析を行った．最も決定係数が大きいのは，土壌水分が飽和状態であった時間の割合との関係であった（R^2=0.65）．さらに，土壌空気の二酸化炭素濃度の平均値を説明変数に加えた重相関分析を実施したところ，決定係数が上昇した（R^2=0.74）．これは土壌水分が飽和状態にほとんどならない場所では二酸化炭素濃度の違いが溶解速度に影響するためと考えられる．土壌水の水質については，大部分でカルサイト飽和度が－ 1.0 以下であり，十分な溶解能力をもった土壌水であった，

野外風化実験の結果から，土壌水分が一年を通して飽和状態である場所では 3.9%/y の石灰岩溶解速度が推定された．すなわち，基盤岩－土壌境界付近の比抵抗値の低い層が一年を通して土壌水分飽和状態であると仮定すると，年間 356 g/m^{2}y の溶解速度に換算される．この結果は同じドリーネでの既存研究で宇宙線生成核種を用いて測定した長期溶解速度（63～256 g/m^2 y）の最大値と比べてやや大きい．地表付近の野外風化実験による溶解速度の値を換算すると 10～298 g/m^2 y と長期溶解速度と同程度であり，現在の溶解速度は過去の値と比べてほぼ等しいかやや増加していることが推定される．また，低比抵抗層はドリーネの底部に限らず，斜面の一部の地下にも存在したことから，ドリーネの形状変化は斜面の一部と底部のいずれにおいても同程度の速度で進行していると予測される．

キーワード: 石灰岩, カルスト地形, ドリーネ, 電気探査, 溶解速度
Keywords: limestone, karst, doline, electric resistivity survey, dissolution rate

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

HGM02-P05 会場:コンベンションホール 時間:5 月 23 日 17:15-18:30

関東盆地中央部におけるコアサンプルの粒度分析と鉱物分析による液状化層位の検討
Granulomeric and mineralogic investigation of liquefaction induced by the 2011 megaquake at the Watarase flood-retarding

瀬戸 真之[1*], 浅井　崇彰[2], 北沢 俊幸[2], 小口 千明[1], 田村 俊和[2]
SETO, Masayuki[1*], Takaaki Asai[2], Toshiyuki Kitazawa[2], OGUCHI, Chiaki T.[1], TAMURA, Toshikazu[2]

[1] 埼玉大学地圏科学研究センター, [2] 立正大学
[1]Geosphere Research Institute of Saitama University, [2]Rissho University

The 2011 Off Pacific Coast of Tohoku earthquake of Mw9, which recorded a seismic intensity of JMA scale 6 in central Kanto, induced liquefaction at the northwestern part of the Watarase flood-retarding basin in the central part of the Kanto basin. The area is located in a former pond into which floodwater of the Watarase river and a few tributaries flew frequently. We collected boiled sand and carried out boring investigation to loosely-deposited sand and mud alternation at four sites (sites A-D) to identify the layers which caused liquefaction. At site D, we had a 500cm deep core sample. We observed some layers; 0-30cm: artificial ground, 30-70cm: silt, 70-250cm: medium or fine sand, 250-400cm: clay, 400-500cm: medium sand. Ground water level was 200cm deep. Bowling sites A, B and C were almost similar to site D. Grading and mineral analyses carried out by liquefaction deposits and core samples. From the ground water level and grading and mineral analyses, we considered that liquefaction layer was the medium and fine sand of around 200cm deep. In comparison of granulometry and mineral composition of boiled sand with those of borehole-core samples below watertable, we identified the layers which were liquefied as follows: site A- medium and fine sand (134-157cm deep) and medium sand (187-232cm deep), site B-coarse or medium sand (160-195cm deep), site C-fine sand (193-255cm deep), site D-fine sand (210-245cm deep) and fine sand (399-422cm deep). All the liquefied sandy layers are correlated to the uppermost members of the Holocene deposits which were interpreted to have been formed during recent 2000years.

キーワード: 東北地方太平洋沖地震, 液状化, 粒度分析, 鉱物分析, 関東盆地中央部, 渡良瀬遊水地
Keywords: The 2011 Off Pacific Coast of Tohoku earthquake, liquefaction, grading analysis, mineral analysis, central part of the Kanto basin, Watarase flood-retarding basin