

HGM002-01

会場:301A

時間:5月25日 16:30-16:45

モンゴル、フデル泥炭地における完新世の古環境復元 The Holocene Environmental Change at Khuder Peat Land, Northern Mongolia

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モンゴル、フデル泥炭地においてボーリング作業を行い、得られた泥炭試料のうち二本について

珪藻分析、花粉分析を行った。モンゴルの自然環境は気候変動に非常に敏感で、近年の地球温暖化においても世界平均よりも大きな変動が観測されている。特に北部のタイガの針葉樹林が広がる地域では、急速に永久凍土が失われている。また、モンゴルにおける気候システムが他のアジア地域よりもよく分かっていないこともあり、その解明の手掛かりとしてこの地域の過去の気候変動、特に完新世における気候変動の復元が求められている。今回、ウランバートル北方に広がるヒンティ山脈内の窪地状の地形に形成されたフデル泥炭地で、保存が良好で完新世の間に堆積した泥炭試料が得られた。

二本のボーリング試料の珪藻分析の結果、完新世初期の氷河の融解などによってできた流水環境から、低層湿原を経て現在のミズゴケの繁茂する高層湿原に至る遷移過程が復元された。二本の試料のデータ間では通時的には多くの違いが見られたが、これには二地点間の地形の違いが影響していると考えられる。珪藻種の突発的な変化による短期間の湿潤化や乾燥化などの環境の変化が見られたが、その一部は、世界的に観測されている北大西洋を発生源とする環境変化と一致しているものがあつた。特に、小氷期や、中世の温暖期と呼ばれる気候変動によるものとみられる変化があり、主に偏西風の変動が大西洋からアジア内陸部にも伝播したと考えられる。

花粉分析の結果では、完新世の中期のマツ属の増加による乾燥化や、後期のカバノキ属の増加に

よる湿潤化が見られ、この二つの変化も世界的な環境変動と関連付けることができた。完新世はおよそ初期から太陽の日射量が低下し続けており、モンスーンの影響が大きい中国などでは、漸次降水量が下がっていく傾向が多くの花分析結果に見られるが、今研究のような変化が見られるのは、複雑な降水と蒸発の収支バランスや気候システムが関係していると考えられる。

キーワード: 完新世, 気候変動, モンゴル, 泥炭地, 珪藻分析, 花粉分析

Keywords: Holocene, Climatic Change, Mongolia, Peat Land, Diatom Analysis, Pollen Analysis

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HGM002-02

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モンゴル北部ダラハド古湖の地形環境変動に関する予察的報告 Preliminary report on limno-geomorphological changes in Darhad Basin, Northern Mongolia

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Proper interpretation of long-term environmental changes is of great help for future provision and prosperity of human beings only when it is based on process- and mechanism-understanding. In general it is difficult to understand long-term records appropriately on the basis of physical, chemical and biological processes because they are complex and lack of quantitative information available for mathematical models to be used for prediction. In this context lake-catchment systems are one of possible promising ones for providing long-term information with process-understanding. Studies on temporal changes in lake-catchment systems may make clear correlations between landscapes and environmental changes through sediment information and lake-catchment observation, both in short-term and long-term.

We (Darhad Drilling Project (DDP) group) have made some expedition and core-sampling in Darhad paleo-lake, northern Mongolia for clarifying long-term hydrological changes and geomorphic processes since 2009. Here we introduce the outline of the project and some preliminary results of long lacustrine sediments from the lake.

キーワード: 湖沼 - 流域系, 湖沼堆積物

Keywords: lake-catchment system, lacustrine sediments

HGM002-03

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Limno-geomorphological changes during Late Pleistocene and Limno-geomorphological changes during Late Pleistocene and

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Limno-geomorphological changes during Late Pleistocene and Holocene in Inner Continental Asia

This study aims to reveal limno-geomorphological changes during Late Pleistocene and Holocene on the bases of the physical and chemical analyses of the lacustrine sediments obtained from Lake Khuvsgul in Mongolian Plateau and Lake Siling-co in Tibetan Plateau. Analytical results of the sedimentary sequence in Borsog Bay of Lake Khuvsgul shows certain environmental shifts at about and 4.0 kyr BP and 6.0 kyr BP; noticeable increases are detected in grain sizes, mineral content and grain density during the periods when the organic matter, biogenic silica and diatom abundance decreased. Bottom sediments in Lake Siling-co indicates comparatively large fluctuations in hydrological conditions at a water inflow for a short-term period at about 1.5 kyr B.P and 10.0 kyr B.P, when rapid coarsening and carbonating within lacustrine deposits occurred as a result in drops of lake level. Limno-geomorphological changes in the both lacustrine catchments imply a relation with large discharge of melting water from high mountains surrounding the lakes. Although, it shows the both plateaus are differently responsible to climatic changes during the Late Pleistocene and Holocene.

キーワード: Limno-geomorphology, Late Pleistocene, Holocene, Plateaus, Mongolia, Tibet

Keywords: Limno-geomorphology, Late Pleistocene, Holocene, Plateaus, Mongolia, Tibet

HGM002-04

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Quantitative analysis of lithologic and tectonic influences on the topographic profiles of Danxia landforms Quantitative analysis of lithologic and tectonic influences on the topographic profiles of Danxia landforms

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"Danxia landform" is a landform made up of non-marine red clastic rock and characterized by red walls and red cliff caused by long-term fluvial dissection. Mountains and hilly lands dissected by fluvial processes including Danxia can be characterized by stream longitudinal profiles and valley transverse profiles. Therefore, longitudinal and transverse profiles of Mt. Danxia in China have been extracted from DEMs, and a series of morphometric analyses were conducted to infer lithologic and tectonic influences on landforms. Mt. Danxia is the place where the term "Danxia landform" was coined. Its general topography has been affected by fractures caused by crustal movement. The area is underlain by two formations of sedimentary rocks: the Changba Formation and the Danxia Formation.

The extracted longitudinal profiles for 45 river basins were analyzed using the stream length gradient index (SL index), the slope-area relationship and the concavity index. Abnormally high SL values occur where a river crosses a fault or rock resistance changes significantly. The slope-area relationship often exhibits a pronounced break related to the spatial scale of the drainage basin. The concavity index tends to increase from the western area of the Jinjiang river basin, underlain mainly by the Changba Formation, to the eastern area underlain mainly by the Danxia Formation. The index is relatively high in the center of Mt. Danxia. The morphometric characteristics of the transverse profiles were also examined in relation to lithology and tectonics. The results provide one of the first quantitative geomorphological evaluations of Danxia landforms.

Keywords: Danxia landforms, SL index, Longitudinal and transverse profiles, DEM

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HGM002-05

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Fault-scarp knickpoint recession and subsequent riverbank widening in central Taiwan Fault-scarp knickpoint recession and subsequent riverbank widening in central Taiwan

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Along the Chelungpu thrust fault in central Taiwan whose surface rupture emerged by the 921 Chi-Chi Earthquake on September 21, 1999, knickpoints were formed in the rivers crossing the fault and some of them have continued to recede upstream by fluvial erosion. The rates of recession of these knickpoints have been extremely high as noted in our previous reports. Also, as the knickpoints recede very quickly, inner channels were formed downstream of such knickpoints with a depth of several meters. The inner channels seem to expand their width after the passing of the knickpoints. Here the temporal changes in the morphology of the bedrock rivers around the fault scarp are examined by means of field topographic measurement and satellite imagery investigations. The rates of the knickpoint recession vary through the time; for instance, the knickpoint in the Ta-chia River shows recession rate 3.3 m/y in the earlier 6 years (1999-2005) and 220 m/y in the last 4 years (2005-2009). Such variations in the recession rates could be mainly caused by the variations in flood intensity and frequency and artificial modifications, rather than the bedrock strength variability.

Keywords: knickpoint, bedrock erosion, field measurement, satellite imagery

HGM002-06

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日本および韓国に見られる岩塊堆積物 Block deposits in Japan and Korea

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This study examined aspects of slope processes corresponding to climatic changes on low altitude mountain slopes based on geomorphic and stratigraphic investigation of slope deposits. Using the name "block deposition feature" which has no implication of particular formation processes for so-called block streams. There are many block deposition features and block fields in Japan and Korea. This study analyzed the morphological characteristics of a block deposition feature near Mt. Yokone on Kobugahara Plateau in the northern part of the Ashio mountains, composed of granodiorite. New findings are concerning the age and the formative processes of slope deposits on the Kobugahara plateau, northern part of the Ashio Mountains, which are composed of granodiorite with thick weathering crust. Many blocks which are originated from core stone distributed on the plateau. At Mt. Yokone in the Kobugahara, the block deposition feature is located in a valley head. A few streams spring out from the both sides of the block deposition feature, and seeps under the blocks. After detailed survey of longitudinal and cross sections and plan forms of the block deposition feature, the feature is divided into the three segments: A, B, and C. Segment A and C show narrow forms and thin block deposits, while segment B is wide with thick block deposits. There are some lobes on Segment B. Segment A and C are run-ways of blocks and segment B is a zone of block deposition. It is indicated that core stones moved on slopes. Since there are some lobes on Segment B, slow mass movement may have played a role in its formation. Superficial deposits of slopes consist of the gully-fill colluvium, the upper slope deposits, and the lower slope deposits. The upper slope deposits are composed of humic soil and silty-clay layers. The lower slope deposits include blocks, fragments of weathering rind, and pumice and scoria correlated to Ag-KP(45-50 ka) and Nt-I (14-15 ka), respectively. Blocks and fragments of Ag-KP are randomly scattered in brown silty matrix, while Nt-I fragments are contained in the upper part of the lower slope deposits. The gully-fill colluvium composed of silt-clay and blocks fill gullies excavated in the lower slope deposits. Block deposits which form block deposition feature also fill troughs excavated in the lower slope deposits. The above evidence indicates that the period of slope instability, which denotes the phase of active colluvium migration on slopes in changing environment, started around the fall of Ag-KP and ended before the Nt-I falling. After the period, block deposition features were formed. Facies and the mode of occurrence of the lower slope deposits suggest that they were formed with some kinds of slow mass-movement, which acted extensively on several geomorphic positions. Not only their facies but also their age do not exclude that these processes were active in periglacial environment. This conclusion contributes to reveal slope processes corresponding to climatic changes on low altitude mountain slopes.

Keywords: block stream, block deposition feature, block fields, slope processes, Korea, Ashio mountains

HGM002-07

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Analysis of hydrological deep-seated landslides triggering mechanisms in Mt. Wanitsuka, Kyushu Island.

Analysis of hydrological deep-seated landslides triggering mechanisms in Mt. Wanitsuka, Kyushu Island.

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In September 6th of 2005 Kyushu Island was hit by the typhoon No 14 causing several damages and large slope collapses, such as deep seated landslides and debris flows. Some of them took place in Mt Wanitsuka, Miyazaki Prefecture. This study has the objective to analyze the hydrological conditions which trigger deep-seated landslides in Mt. Wanitsuka. For that purpose it had been controlled three small catchments in the vicinity of a deep seated landslide scarp which took place in 2005, from 2008 until the present. In those catchments it was installed parshall flumes and water samplers to control runoff O18/Deuterium isotopic concentration and ionic concentration. Additionally in the area it was installed 2 boreholes, 40 m and 10 m depth, to control the groundwater level and one pluviometer. The geology of the mountain is mainly shale interbedded sandstone highly fractured. According to previous studies based on analysis of effective rainfall and groundwater level, the effective rainfall with a half life of 84 hours show the best correlation with the lag time between the peak of rainfall and groundwater level peak (Tanaka, 2010). Using that correlation it was possible to estimate the timing of landslides event in 2 min after the rainfall peak. That agrees with the estimation time of landslides occurrence which is 30 min. after the rainfall peak. In other hand, Takahashi (2010) analyzing the Ca²⁺ concentration of streams water in the same study area demonstrated the high correlation between the sites where deep seated landslides deposit are located and the influence of deep ground water. The isotopic analysis of runoff shows a significant pulse of "old water" during the rising limb of the runoff hydrograph. That pulse was observed for precipitation with regular intensity (30 mm/hr as a peak) and accumulated rainfall of about 200 mm (in 20 hours). For the next rainfall events with similar intensity but smaller duration (smaller accumulated rainfall) the pulse of "old water" progressively reduced. This evidence suggests the importance of the accumulated rainfall in the hydrogeological response of the catchments in the study area and therefore it has an important role in the triggering of deep seated landslides over the high intensity rainfall. That agrees with the characteristics of the trigger precipitation of the landslides in 2005, with about 40 mm/hr as a peak intensity but 900 mm of accumulated rainfall at the estimated time of landslides occurrence. For that reasons it is suggested that the analysis of deep seated landslides triggering mechanisms must consider a variable, based on the accumulated rainfall as the effective rainfall, which indicated of the volume of water stored in the bedrock trough the time in order to estimate the critical volume to trigger deep seated landslides in the area.

キーワード: Mt. Wanitsuka, Deep-seated landslides, Landslides triggering mechanisms, Kyushu, 2005

Keywords: Mt. Wanitsuka, Deep-seated landslides, Landslides triggering mechanisms, Kyushu, 2005

HGM002-08

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砂の不足する場におけるベッドフォーム配列の特徴：水路実験と野外観察 Bedform distribution where the substratum is partly covered with sand: field observation and flume experiment

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In the area where the substratum is partly covered with sand, the characteristic bedform distributions composed of dune trains surrounded by sand ribbons and sand patches are developed. I conducted the field observation and flume experiment on the distribution in order to investigate the forming processes and conditions.

Field observation in Kizu river: Unique bedforms in the area where there are insufficient sand to cover whole surface were observed in the field observation in Kizu river. Typhoon No.18 in 2009 gave a heavy rain to the south and central Kinki area, then the water level of Kizu river rose approximately 6 m. There were not only the barchan (lunate) and transverse dunes but also sand patches without a sharp crest line and sand ribbons lying parallel to the streamline on the athletic fields in the flood channel of Kizu river.

The distributions of the bedforms were also characteristic. These distributions had the same features as the block diagram on the distribution of bedforms formed by tidal flows on the seafloor (Belderson, 1982). For example, barchan dunes and sand ribbons existed adjacently, a sand patch field laid at the downstream side of a dune train, and sand patches composed of the coarser grains at the upstream side of a dune train.

Flume experiment: The same bedform distributions as the field observed were formed in the flume experiment. The flow velocity spatially varied in the range from 23 to 33 cm/s (at 5 mm above the bottom of flume) due to a gentle (1:100) slope on the bottom of the flume. The initial topography was a flat sand bed of 240 g weighted moderately-sorted very fine sand (0.11 mm in mean diameter, 0.72 in the standard deviation). The developing processes of the bedform distribution were recorded from the top of the flume.

In the first stage of the experimental run, dune trains developed at the upstream side. At the same time, the downstream part was covered with sand patches. While the dune train developed from the sand moving in traction, the sand patches were formed from suspended sand. The growth rate of the dunes was much lower than that of the sand patches.

The dune train migrated into the field covered with sand patches after formation of the dunes. This is because the dunes move to the downstream direction, although the sand patches hardly move. In the boundary area between two bedforms, a new crest line was formed on the sand patches. The spacing between the new crest and the existing crest at the downstream end of the dune trains was the same as the wave length in the dune train.

Reference: Belderson, R. H., Jonson, M. A. and Kenyon, N.H., 1982. Bedforms, pp.27-57. In: Stride, A.H. (Ed.), Offshore Tidal Sands Processes and Deposits. Chapman and Hall, London, New York, 222p.

キーワード: バルハン, 砂丘 (砂堆), サンドパッチ, サンドリボン, ベッドフォームの配列, 木津川

Keywords: barchan, sand dune, sand patch, sand ribbon, distribution of bedforms, Kizu river

HGM002-P01

会場:コンベンションホール

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ネパール西部における地震を考慮した斜面崩壊の脆弱性マッピング Landslide susceptibility mapping considering earthquake in west Nepal

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2005年パキスタン北部地震のときに生じた斜面崩壊の分布データを教師データとし、活断層からの距離、傾斜、凸度、尾根谷密度の4つを説明変数としてネパール西部の27km × 27kmの対象地区の地震時の地すべり脆弱性をマッピングした。活断層からの距離については、対象地区のMain Boundary Faultについては横ずれ断層を想定し、Himalayan Frontal Faultについては上盤・下盤を区分して計測した。残りの三者については、30m解像度の数値標高モデル(Digital Elevation Model, DEM)から計算した。脆弱性の分類にはInformation Value(InfoVal)の方法を用いた。その結果、Very low(崩壊面積率, 0-1%。以下同様), Low(1-3%), High(4-9%), Very high(10-75%)の4分類の脆弱性がマッピングされた。ただし、崩壊面積率に応じた閾値の決定については客観性を持たせることが今後の課題である。

キーワード: 地すべり, 脆弱性, ネパール, 地震, 断層

Keywords: landslide, susceptibility, Nepal, earthquake, fault

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HGM002-P02

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西ジャワ, バンドン盆地南西縁における地形発達が農業景観の差異に与える影響 Geomorphic development in a basin fringe in West Java and its effect on agro-landscape differentiation

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西ジャワ, バンドン盆地の南西縁では, 盆地底に連なる小扇状地の背後に, 新第三系火山岩・火砕岩が侵食された丘陵地と, それに覆いかぶさる中期(?)更新世の開析された火山が連なっている. このような地形の配置が形成されてきた過程を発達史的に考察した. この地域には, タケ栽培を組み込んだ特異な輪作で特徴づけられる伝統的な農耕が, 他の耕作様式とすみ分ける形で残っていて, 湿潤熱帯傾斜地でのサステナブルな土地利用の一つとして注目されている. その存続に関わる地形条件(表層地質や水文の条件も含む)の地域的差異を調べ, その差異を作り出した地形発達史との関係について検討した. その結果, 開析史を反映した, 局地的急斜部をともなう複雑な斜面が, 広域的な伐採を要する耕作方式にとって阻害要因になる一方, 小規模な水源を多数確保して, こまごまとした耕作の場を提供していることが窺われた.

キーワード: 熱帯, 丘陵地, 古期火山, 地形発達, 農業景観, ジャワ島

Keywords: Tropics, Hills, Old volcano, Geomorphic development, Agricultural landscape, Java

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HGM002-P03

会場:コンベンションホール

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台湾の石門ダム流域における遷急点について Knickpoints in Shihmen Reservoir Watershed

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The Shihmen reservoir watershed, northern Taiwan, has many knickpoints, which could be interpreted as a response of river incision against base-level lowering probably by uplift. The drainage network of Shihmen reservoir watershed is framed by trunk Dahan River, its three major tributaries and many minor tributaries. The knickpoints are identified from longitudinal profiles by using a 12-m DEM. A strong power-law relation is presented between drainage area above a knickpoint and distance from drainage divide to a knickpoint. There is a poor power-law relation between drainage area above a knickpoint and elevation of a knickpoint. Major tributaries have four or five major knickpoints each, and one knickpoint along one major tributary can be correlated to a knickpoint along another major tributary. This is indicative that landscapes respond to base level lowering via upstream propagation of knickpoints. Most selected third-to first-order minor tributaries display prominent steep reach at the confluences with trunk or major tributaries with relative height of several tens to a few hundred meters. The minor tributaries of the major tributaries also have knickpoints, which are frequent on higher-order streams and could be correlated to each other and to the knickpoints along the major tributaries. This does indicate that knickpoints in these tributary basins are the result of multiple episodes of base-level lowering on Dahan River.

キーワード: 遷急点, 河川下刻

Keywords: knickpoints, river incision

HGM002-P04

会場:コンベンションホール

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日本の山地河川における巨大岩塊の運搬プロセス Transport processes of huge debris in Japanese mountain river basins

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Some of the Japanese mountain river basins have huge debris, sometimes larger than 10m, on their riverbeds. This study aims to discuss transport processes of huge debris. The investigated river basins are the Tedor River in central Japan and the rivers on the Yaku Island in southern Japan. The diameter of such huge debris was measured in the field and the channel slope was derived using 1:25,000 topographic maps. Further geomorphological investigations were performed in the field and using air photo interpretations.

The Tedor River is a 70km-long river that originates in the Hakusan volcano (2,702m a.s.l.). Its drainage basin was affected by heavy rainfall in July 1934. Snow-melt water and heavy rain caused severe flooding along the whole river course and many landslides in the headwater region. The valley of the upper reaches was buried about 20m deep. After the flood, much huge debris was seen on the riverbed. The largest one was 20m in diameter. It was named "Hyakumangan-iwa", which means a rock of about 4,000 tons in weight. The debris was carried from the upper tributary basin, because the geology of the basin is the same as that of the debris. A landslide with huge debris and small lacustrine-like deposits in the valley floor was found in this basin by field survey. This means that huge debris, including the Hyakumangan-iwa, was transported by the torrential flood as a small landslide dam gave way. During the event many landslide dams would form and break up, so that large amounts of debris ran down and buried the valley floor.

Many rivers on the Yaku Island, one of the UNESCO World Heritage Sites, also have huge debris on their riverbeds. Sometimes debris is as large as 10m in diameter. Detailed field survey carried out along the Miyanoura River has shown that the maximum diameter of the debris decrease downstream according to decrease in channel slope declivity. Huge debris as large as several meters in diameter, was also found on the riverbed with a 5% channel slope declivity. It means that the huge debris is transported downstream by the flood under a sorting process. Based on air photo interpretation, huge debris, found at the junction of the mainstream with its tributary, jams the valley floor of the main stream. This shows that huge debris produced in a tributary blocked up the valley floor of the mainstream forming a dam-lake. When the debris dam gave way, torrential flood occurred and huge debris was washed away. Because the debris underwent a sorting process, only smaller debris was transported to the lower reaches with gentler channel slope.

Formation and breakage of debris dams caused by landslides and/or debris supply from tributaries is very important for debris transport in the Japanese mountain river basins.

Keywords: debris transport process, torrential flood, mountain river, debris dam, Japan

HGM002-P05

会場:コンベンションホール

時間:5月24日 16:15-18:45

石造建築物で使用されている天然・人工石材の塩類風化に関する一実験 Influence of rock properties on salt weathering of natural and reconstituted stones: An experimental approach

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石造建築物の劣化被害の一つとして、塩類風化現象がある。本研究では、塩類風化における岩石物性の影響を調べるため、5種の石材を用いて実験を行った。石材の種類は、(1) 生物遺骸に富む石灰岩; the Bajocian limestone (BL), (2) 砂岩質石灰岩; the Sinemurian limestone (SL), (3) これら2種の石灰岩の碎屑物をセメント等で固めた人工石; reconstituted stones (RS), (4) 多孔質で若干の生物遺骸を含む石灰岩; the Savonniere limestone (SV), (5) 大谷石; Oya tuff (OY) である。(1)~(3)の石灰岩および人工石はベルギー南部のオーバル修道院で使用され、(4)の石灰岩はフランス北部のランス大聖堂で使用されている。大谷石は変質した流紋岩質凝灰岩であり、日本を代表する石材の一つである。まず、これらの石材の岩石物性を調べた。空隙率および圧裂引張強度は、それぞれ、RSが29.0% \pm 3.05 MPa、SLが12.9% \pm 4.82 MPa、BLが34.8% \pm 1.38 MPa、SVが40.0% \pm 1.41 MPa、OYが38.9% \pm 1.85 MPaであった。これらの石材について、直径4.5 cm \times 高さ5 cmの供試体を作成し、20 $^{\circ}$ Cの室内において塩溶液の毛管上昇試験を行った。使用した溶液は、20 $^{\circ}$ CにおけるNa₂SO₄飽和溶液(16% Na₂SO₄ solution)、その半分の濃度の溶液(8% Na₂SO₄ solution)、および比較対象としての蒸留水である。16% Na₂SO₄溶液における毛管上昇速度は、BL、SL、RS、SV、OYの順であった。8% Na₂SO₄溶液では、BL、RS、SV、OY、SLの順であった。この実験後に析出した塩を除去したところ、引張強度がBLやSVよりも高いRSでは完全に破壊されていたものの、他の岩石では顕著な破壊が見られなかった。劣化が比較的速いとされるOYにおいては、供試体の上端縁のみわずかに劣化していた。以上のことから、劣化の原因は岩石の持つ強度のみならず、その構成物質や空隙構造に影響されることが分かった。

キーワード: 塩類風化, 石灰岩, 大谷石, 岩石物性

Keywords: Salt Wethering, Limestone, Oya Tuff, Rock Property