Japan Geoscience Union Meeting 2011
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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った。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粉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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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 mechanical-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: 湖沼ー流域系, 湖沼堆積物
Keywords: lake-catchment system, lacustrine sediments

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HGM002-03 会場:301A 時間:5 月 25 日 17:00-17:15

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

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HGM002-04 会場:301A 時間:5 月 25 日 17:15-17:30

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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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

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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

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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 Ca+2 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

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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 st 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