# Long-term hydrogeomorphological changes inferred from lacustrine sediment information

*Kenji Kashiwaya[1]

1. Institute of Nature and Environmental Technology, Kanazawa University

The Lake Biwa sedimentary records (200-m core and 1400-m core) cover the last 4 Myr, but detailed information is limited in the upper part of the sediment (250 m; ca. 450 ka). The information of the Lake Baikal sedimentary records used here for comparison is limited during the past 780 kyr although the records obtained until now cover the last 10 Myr. It is already reported that long and short Milankovitch cycles are printed in the lacustrine records of the two lake-catchment systems. Lacustrine information should be interpreted through geo-environmental settings. In this presentation Lake Baikal and Lake Biwa sedimentary information will be discussed in the viewpoint of long-term hydro-geomorphological fluctuation with geo-environmental settings. The sedimentary items used for discussion are grain size (sediment and mineral), organic content, bi-$SiO_2$ content, HCl-soluble content, and mineral content of both lacustrine sediments for the past 450 kyr and 780 kyr, respectively. Common and different trends for the both systems will be discussed.

Keywords: long-term hydrogeomorphological changes, lacustrine sediments, lake-catchment system

 

# Effects of permeability on the development of experimental landform

*Shunji Ouchi[1]

1. Faculty of Science and Engineering, Chuo University

Uplift rate and rainfall intensity are the main factors controlling the development of experimental erosion landform. However, characteristics of sand mound to be eroded (mainly permeability) are also an important factor determining the way of experimental landform development. This time I would like to discuss the development of experimental landform with uplift and rainfall erosion from the view point of effects of permeability of sand mound, especially based on the results of runs with the same uplift rate (0.36mm/h), runs 26, 27, 32 and 38.

run-------permeability----------precipitation---------width of deposition area
26--------2.57x10$^{-4}$cm/s---------40-50mm/h----------100mm
27--------3.23x10$^{-4}$cm/s---------80-90mm/h----------100mm
32--------1.84x10$^{-4}$cm/s---------80-90mm/h----------200mm
38--------1.53x10$^{-3}$cm/s---------80-90mm/h----------200mm

When a square sand mound is uplifted from a flat surface under the mist type artificial rainfall, fluvial erosion starts from the edge of uplifted area and this erosion soon develop into valley systems. The advance of valley erosion as the mound elevation increases by uplift results in the development of slopes, and slope failures occur frequently. Stream channels become relatively stable and become paths of transport for the material yielded by slope failures. Sediments are discharged from the system effectively by this fluvial process. Large slope failures or landslides tend to occur concentratedly with a certain cycle, and the average mound height change around a certain height, decreases in the periods of landslide concentration and increases with uplift between these periods. This height seems to be determined by the rate of uplift except in the case of extremely high uplift rate.
Permeability and strength of sand mound is considered to be determined by the degree of compaction as far as the same material (a mixture of fine sand and kaolinite 10:1 by weight) is used. While density, which is considered to represent the degree of compaction, have a clear negative relation topermeability, shear strength of saturated material does not show clear relation to density. The degree of compaction apparently controls permeability but not shear strength at least in this series of experiments. Runs 26 and 27, the deposition area of which is 100 mm wide, are different in rainfall intensity, while runs 32 and 38, both of which have 200 mm wide deposition area, different in permeability. However, difference in the development of experimental landform within each pair of runs shows a certain similarity. Relatively low and flat surface with sporadic steep small hills developed in runs 27 and 32, while relatively high and massive mountains appeared in runs 26 and 38. Rainfall intensity is lower in run 26 than in run 27, and permeability is higher in run 38 than in run 32. Assuming that permeability controls the amount of surface runoff, high permeability in run 38 can be considered to have effects similar to the low rainfall intensity in run 26. The estimated amounts of surface runoff, calculated by subtracting the value of permeability (cm/s) from precipitation (mm/h), are 8.4-11.4x10$^{-4}$, 6.4-9.7x10$^{-4}$ cm/s in runs 26, 38, and 2.0-2.3x10$^{-3}$, 1.9-2.3x10$^{-3}$ cm/s in runs 27, 32, respectively. Runs 26 and 28 have the amount of surface runoff a digit larger than runs 27 and 32. Large amount of surface runoff promotes faster valley erosion longitudinally and laterally, and the development of low and flat surface in runs 27 and 32. In runs 26 and 38, on the other hand, valley erosion was not so active as in runs 27 and 32, and high and massive mountains formed with frequent landslides as a result. Effects of shear strength are uncertain this time; however,

 

observation on the series of experiments including other runs revealed that the strength of sand mound has some effects on the way of slope failure.

Keywords: development of experimental erosion landform, uplift, permeability, shear strength, surface runoff, slope failure

 

# Distibution of Sans Dunes with a Cellular Model

*Atsunari Katsuki[1]

1. Nihon University

Sand dunes are found in many places such as deserts, the sea bottom and the surface of Mars.Most fascinated dune is barchan, which is crescent dune. We reproduced many barchans in numerical simulations and investigate the dynamics. The motion of sand grains is realized by two processes: saltation and avalanche. Saltation is the transportation process of sand grains by flow. We reproduced a lot of barchans in numerical field by above model. Barchan releases sand from tips of two horns. The downwind barchan can capture the sand stream. Also, barchans sometimes collide each other. These direct and indirect interaction forms complex barchan fields. The size distribution of a few thousand of barchans is fitted by lognormal distribution well. This indicated that the small barchans exist around the large ones and the large barchans are around small barchans. The average size of barchans increase as the amount of supplied sand do.

Keywords: sand dune, size distribution

 

# Relationships between rainfall, water level fluctuation and landform change of riverbed since 2011 in Kamikochi region, the upper Azusa River, central Japan

*Hiroshi Shimazu[1]

1. Department of Geography, Faculty of Geo-Environmental Science, Rissho University

The purpose of this study is to discuss relationships between rainfall, water level fluctuation and landform change of riverbed in Kamikochi region, the upper Azusa River, central Japan. Based on ground surveying geomorphological maps of the observation area were made every year in summer season. Interval shooting cameras took photographs every 15 or 20 minutes interval. Rainfall data were obtained from AMeDAS Kamikochi station. Also section surveying performed every autumn season. The analyses of this study were performed using the data since 3 July 2011 when the cameras were set.
The rainfall event whose daily rain fall over 100 mm in the Baiu rainy season caused the bankfull discharge and the major landform change, which was channel migration. When the channel migration occurred, without gradual lateral move of channels, former channels were buried and/or narrowed with new main channels excavation. During the Baiu rainy season about 80mm of daily rainfall caused small landform changes, for example slight lateral erosion by channel move. Any landform changes were not occurred during under 50mm/day rainfall event in the Baiu rainy season and even about 100mm/day rainfall event after the Baie rainy season.

Keywords: fluvial geomorphology, landform change, lateral erosion, rainfall, watar level fluctuation, Kamikochi

 

# The estimation of a rainfall index triggering landslides based on hydrological observations at Mt. Mihara, Izu-oshima Island, Japan.

*Naofumi Takeda[1], Tsuyoshi Hattanji[2], Yuki Matsushi[3], Tomomi Terajima[3]

1. Nippon Koei Co., Ltd, 2. University of Tsukuba, 3. Disaster Prevention Research Institute, Kyoto University

Typhoon Wipha brought many shallow landslides in Izu-oshima Island on 16 October, 2013. We investigated the physical properties of slope materials and the subsurface-water responses for rainstorms at a shallow landslide site. Alternation of tephra and loess layers within 2.5 m depth overlays the basaltic spatter and lava around the investigated site. Slip surface of the shallow landslide was formed in a tephra layer (the so-called Y1.0). The Y1.0 tephra layer mostly composed of sand had a hydraulic conductivity of approximately $10^{-3}$ cm/s with the high gravitational drainage capacity (5-10%). The loess layer within ~115 cm depth mostly composed of silt and clay had a hydraulic conductivity of $10^{-5}$ cm/s and high water retention capacity (50-55% within the field capacity). During a rainfall event with total rainfall more than 97 mm, the positive pressure head was observed both in the loess layer and in the bottom of Y1.0 tephra layer above the loess layer.Statistical analysis based on the records of 14 rainfall events from 2014 to 2016 showed a liner relationship between maximum pressure heads and an antecedent precipitation index (half-life of 4 hours). Based on statistical analysis of the past severe rainstorms, the slope would become unstable with the antecedent precipitation index (half-life of 4 hours) more than 217-253 mm. During typhoon 26th event in 2013, the maximum pressure head at the bottom of the Y1.0 tephra layer could have reached at +5.4 kPa. This high pore-water pressure in the Y1.0 tephra layer must be a cause of the shallow landslide in 2013.

Keywords: tephra, loess, alternation, hydraulic conductivity, subsurface storm flow, antecedent precipitation index

 

# Vertical changes of soil properties and infiltration process for occurrence of shallow landslides in hillslopes with different bedrocks

*Takuma Watakabe[1], Yuki Matsushi[2], Masahiro Chigira[2]

1. Graduate School of Science, Kyoto University, 2. Disaster Prevention Research Institute, Kyoto University

We examined the vertical change of physical, mechanical, and hydrological properties of soil-slip scars which is formed by rainfall-induced shallow landslides in hillslopes with granite and hornfels. On Granitic hillslopes, there are highly-permeable sand with a large shear resistance angle and a small cohesive strength. Hornfels hillslopes has are covered by sticky and low permeable soil with a small shear resistance angle and a large cohesive strength. Percolation rate from tensiometric data in unsaturated zone of the granite hillslope are higher than that of the hornfels hillslope. Slope stability analysis suggests that many landslides occurred in granite hillslopes does not require a rise of subsurface pore water pressure although in hillslopes of hornfels occurrence of shallow landslides needs a subsurface pore water pressure, respectively. These results suggest that factors for landslide occurrence are different in each hillslope.

Keywords: Granite, Hornfels, Shallow landslides, 2014 Hiroshima landslide Disaster

 

# Effect of shallow landslides on migration of channel heads: Case studies in Hiroshima City and Hofu City, western Japan

*Tsuyoshi Hattanji[1], Ryuya Kodama[2], Daichi Takahashi[2], Shoji Doshida[3], Yasushi Tanaka[4], Takahisa Furuichi[5]

1. Faculty of Life and Environmental Sciences, University of Tsukuba, 2. College of Geoscience, University of Tsukuba, 3. National Research Institute of Fire and Disaster, 4. Faculty of Letters Komazawa University, 5. Graduate School of Agriculture, Hokkaido University

The temporal variation in channel-head location due to heavy rainfall was examined with topographic analysis using 1-m grid DEMs and field survey in granitic mountains in Hiroshima City and Hofu City where debris-flow disaster occurred during a recent decade. For both cases, the total number of channel heads increased after the heavy rainfall events, and post-event (new) channel heads formed by the heavy rainfall were located upslope from pre-event channel heads. Although pre-event channel heads had no significant correlations between source area and local slope for both areas, post-event channel heads with shallow landslides induced by the heavy rainfall had strong inverse correlations between them. Subsurface flow controlled by topographic convergence would cause the strong inverse correlations for both sites. Most pre-event channel heads were located close to springs fed by groundwater flow, and old landslide scars were confirmed headward slope of the springs. Downstream channels of the springs would be maintained by erosion of stream flow, although old channels would be buried by debris.

Keywords: hillslope, head hollow, micro-landforms, spring

 

# A new approach for marine terrace extraction using DEM

*Junki Komori[1], Masanobu Shishikura[2], Ryosuke Ando[1]

1. The University of Tokyo, 2. National Institute of Advanced Science and Technology

We devised a new DEM analyzing method for terrace extraction, working on the southern part of Boso Peninsula, eastern Japan, as a survey area.
Marine terraces are coastal landforms that were originally platforms created by erosion just beneath the sea level and subsequently emerged above the sea surface through relative sea level fall, such as tectonic uplift or climatic sea level fall. For example, the marine terraces in the southern part of Boso Peninsula, where we tried the new method in this study, are considered to be formed by the interplate earthquakes along the Sagami trough. Many researchers surveyed and utilized such marine terraces for the estimations of the paleoearthquakes or the history of sea level changes. For this purpose, it is required to figure out the terrace distributions and obtain the heights and the formation ages of the terraces.
In the previous studies, the terrace extraction was performed, in early times, with aerial photography or field surveys. However, field surveys are time-consuming and thus unsuited method for collecting sufficient amount of data, and aerial photography requires training for reading and further cannot provide height data needed for numerical analyses. Recent studies attempted to numerically extract terrace features using DEM with geomorphological parameters such as slope, relief and curvature. Scott and Pinter (2003) developed a numerical terrace extraction method, focusing on the difference in the values of slope and relief between the terrace cliffs and platforms. Although this method shows successful result with the terraces which have relatively gentle cliff and sufficiently isolated platforms, with the narrow marine terraces, such as the south part of Boso Peninsula targeted in this study, its ability to identify the terrace platforms is weakened.
In this study, we devised the elevation view imaging as the new method for marine terrace features extraction using DEM. This imaging visualizes the terrace features as orthographic projection, where the geomorphological parameters are plotted with respect to the elevations. This method is based on the fact that the terrace features, namely some geomorphological parameters, must have horizontally or mildly sloped uniform distributions given that the terraces are formed at horizontal shoreline.
The study area is the rocky coast, located in the southeastern part of Boso Peninsula, where the erosional coastal features are prominent. There are formed four marine terraces which are considered to emerged during the 1703, M8.2, Genroku Kanto Earthquake and the paleoearthquakes that had similar source areas to it. The DEM dataset used in this study was obtained by using LiDAR and has 0.5 m grid interval.
We adopted a parameter based on positive and negative openness, devised by Yokoyama et al. (1999), for the imaging. This parameter has characteristics that can represent concavities and convexities of landforms restraining the effect of local topographic change. The elevation diagram showed a peak in the vicinity of paleo-shoreline angle. The elevation view imaging with this parameter indicated the continuous peaks at the altitudes corresponding to the terrace cliff features.
Kayanne and Yoshikawa (1984) surveyed this area and obtained the altitude of each paleo-shoreline. These altitudes are substantially matched with the result of this study. The elevation view imaging has characteristics that (1) the images are readily interpreted than aerial photography, (2) the objective criteria for classification is provided that the terrace features are distributed almost lineally in the images, (3) this method is also applicable in the narrow marine terraces which are difficult to distinguish by using the previous DEM analysis methods and (4) the altitudes data, which is important for the estimation of the histories and mechanisms of terrace formations, are simultaneously obtained.

 

Keywords: DEM, marine terrace, Kanto earthquake

 

# A study on regional difference in historical tsunami energy, southern Ryukyu Islands, Japan

*Hisashi Aoki[1], Koudai Kishino[1], Yuichi S. Hayakawa[2], Akira Maekado[3]

1. Tokyo Gakugei University, 2. The University of Tokyo, 3. University of the Ryukyus

A marine terrace having sea cliff develops at the shore of Miyako Islands and Yaeyama Islands. Large and small tsunami boulders are distributed on the terrace. The weight (*W*) of the tsunami boulder and the sea cliff height (*H*) were investigated in this study. *WH* can be an index of tsunami energy. *WH* was large in Miyako Islands. This suggests that energies of historical tsunamis which hit Miyako Islands were larger than those of Yaeyama Islands.

Keywords: Tsunami, Tsunami boulder, Sea cliff height, Marine terrace, Ryukyu Islands

 

# Geomorphological mapping of the continental shelf around the Japanese Islands based on the interpretation of submarine anaglyph images

*Tetsuya Komatsu[1], Atsuto Izumida[2], Takahiro Oka[2], Takayuki Takahashi[2], Katsuhiro Nomura[1], Ken-ichi Yasue[1], Toshihiko Sugai[2]

1. Japan Atomic Energy Agency, 2. Graduate School of Frontier Sciences, The University of Tokyo

One of the primary issues of the geological disposal technology is to advance the techniques associated with investigation/assessment for long-term uplift and erosion in terrestrial-marine transitional zone in Japan. To examine this issue, it is inevitable to understand the geomorphic features indicating uplift and erosion in the continental shelf, which widely emerged during glacial periods. However, available information of the geomorphic features in the continental shelf around Japanese Islands is quite limited compared to the terrestrial area. This would be mainly because an overview sketch of seafloor landforms in the continental shelf around Japanese Islands is still lacking except 1/1000,000 scale “Quaternary map of Japan” (Japan Association for Quaternary Research ed., 1987). In this context, this study aims to produce the submarine geomorphological map showing the morphological features of medium-scale landforms in the continental shelf around Japanese Islands. Identification of the landforms was performed mainly based on visual interpretations of submarine anaglyph images constructed from digital bathymetric charts of Japan Hydrographic Association (M7000 series).

Submarine geomorphological map displays shelf breaks, significant breaks of slope, submarine canyons, and submarine terraces. The shelf breaks were defined as the most seaward convex slope break around the transitional zone between the continental shelf and slope; this definition differs from “Quaternary map of Japan” (Japan Association for Quaternary Research ed., 1987). Submarine canyons were classified in terms of whether they dissect the continental shelf or not. These two geomorphic elements were transferred into shape files (data format for geographic information system) as this will enable quantitative analyses of the landforms present on the submarine geomorphological map.

Submarine geomorphological map provides basic information concerning the geomorphic features of the Japan’s continental shelf. This information is as follows: (1) regional difference of the continental shelf and its depths, (2) distribution of the area, where the extent of continental shelf is constrained by the dissection front formed by submarine canyons and submarine landslides, and (3) distribution of submarine terraces. The future subject of submarine geomorphological mapping is to conduct the identification of submarine active faults, shelf channels, and tidal landforms. Moreover, it will be expected to construct the geomorphological map seamlessly connecting terrestrial area to marine area by incorporating marine terraces and active faults shown in the previous studies into the submarine geomorphological map.

This study was carried out under a contract with METI (Ministry of Economy, Trade and Industry) as part of its R&D supporting program for developing geological disposal technology.

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Keywords: geological disposal technology, seafloor landform, continental shelf, anaglyph, geomorphological map, Japanese Islands

 

# Evaluation of the geomorphic indices using the crustal movement of the 2007 Noto Hanto earthquake, north-central Japan

*Hiroyuki Yamaguchi[1,2], Shigekazu Kusumoto[3]

1. Graduate School of Science and Engineering for Education, University of Toyama, 2. Natural Consultant Co., Ltd., 3. Graduate School of Science and Engineering for Research, University of Toyama

Some geomorphic indices that represented quantitative the landscape shape formed by river erosion have been developed as a basic tool to identify widely the crustal movement, and show a correlation with the relative tectonic activity. In japan, the examination of the activity of the active fault using some indices is not performed. Although the activity of the active fault distributed inland are provided detailed data by the trench investigations, the examination of the activity of the active fault distributed on the seafloor often becomes in limited information such as the former shoreline of the marine terrace. This study calculated some indices in the focal area of the 2007 Noto Hanto earthquake, and compared with the crustal movements.

The 2007 Noto Hanto earthquake ($M_{JMA}$ 6.9) occurred in the coastal area of the northwestern Noto Peninsula. The crustal movement caused by the earthquake was revealed based on geodetic measurements, including InSAR and airborne LiDAR, and the distribution of uplift rate shows tendency to decrease from the north near the epicenter to the south. In addition, the distribution of coseismic vertical displacements based on airborne LiDAR and the height of former shoreline of marine terrace show a similar distribution pattern, and the cumulative uplift associated with the faulting occurs through the Late Pleistocene in this area.

This study examined using six indices: mountain-front sinuosity (Smf), the ratio of valley floor width to valley height (Vf), stream length gradient (SL), drainage basin asymmetry (Af), and drainage basin shape (Bs). Smf is explained as the ratio of length of mountain front along the foot of mountain to the straight length of mountain front. The poorer development of sinuosity means the higher uplift rates, and is consistent with the lower value. Vf is explained by the ratio of width of valley floor to relative elevation between ridge and valley floor. In an area with high uplift rates, topographic profile illustrates a V-shaped profile with the both lower values. SL is explained as multiply the channel slope and the total channel length, and the high value consist with the active tectonics. AF shows tilting of basins, explained as the ratio of the total area of the basin and the area of a basin on the right side of the major stream. Bs shows the shape of basins that calculated by the ratio of the length of a basin and the width of a basin. The basin with high uplift rates is elongate (higher values), and basin shape become more circular with lower or cessation of the activity. In morphometric analysis, the 5-m DEM of the Geospatial Information Authority of Japan publication was utilized.

In the calculation result of 50 basins, Smf and Vf performed lower at the norther part, and the values of the southern part become higher. SL shows similar tendency, but the values vary widely than Smf and Vf. In the values of Af and Bs, these tendencies are not identified. The relationship between these indices and the height of former shoreline show low correlation, correlation coefficients are 0.56 in SL, 0.34 in Smf, and 0.21 in Vf. Therefore, the values of the indices were classified based on basic geomorphic information because it is assumed that the values include influence except the river erosion. As a result, the cases which correlations become higher are as follows; in the case of Smf, the existence of the sea cliff on the front of the sinuosity, in the case of Vf, set the ridge of the cross-section at the same period, in the case of SL, set the topography or geological feature near valley head at the same period. Thus, it is important that the comparison of the index values is careful about the influence of coastal erosion and the geologic time scale in the basin.

 

Keywords: morphometric analysis, river erosion, crustal movement, 2007 Noto Hanto earthquake

 

# Relationship between geology and riverbed form in the tributary river basins of the Naruse River, Miyagi Prefecture, northeastern Japan

*utsushikawa eri[1]

1. Miyagi university of education

I investigated the present riverbed sediment and riverbed form in order to examine the relationship between geology and riverbed form in the mountain river basin. Total 18 study sites were set at every 250 to 500 meters along the Neko and Ono rivers belonging to the Naruse river basin in the Miyagi Prefecture. The geology in the Neko river basin is composed by the highly consolidated andesites of Quaternary in the upper basin and semi-consolidated tuff and/or sedimentary rocks of Neogene in the middle to lower part. In contrast, the Neogene sedimentary rocks and tuff accompanied by the andesite gravel occupy the whole basin in the Ono river. Concerning riverbed form, the gravel riverbed dominated, especially in the upper part of the basin, in the Neko river, while the bedrock riverbed occupied in the upper basin and the gravel one was distributed in the downstream in the Ono river. In the Neko river, the present riverbed gravel, composed mainly of larger andesite, showed poor sorting and low roundness. The matrix consists mainly of sand, and its proportion increased downstream in the Neogene bedrock area. The gravel in the riverbed of the Ono river was smaller, well sorted, and more rounded, particularly in the lower basin. The matrix had relatively high proportion of sand, and the particle-size distribution was more or less similar in all sites.
The differences recognized in the riverbed form and present sediment between two basins are discussed below from the viewpoint of bedrock lithology. It is estimated that highly consolidated andesites, insusceptible to abrasion, produces larger, untransportable, and consequently less rounded gravel in the Neko river basin. As the result, gravel and/or gravel step riverbed are dominant. On the other hand, the semi-consolidated Neogene rocks in the Ono river basin provides abrasive gravel and abundant sand. It is suggested that the riverbed sediment can be easily transported and, in consequence, the bedrock riverbed become dominant in the upper basin. In the lower part of the basin, smaller tractive force due to gentle bed slope and presence of the andesite gravel yielded from the tuff result in the formation of the gravel riverbed.

Keywords: Mountain river, Riverbed form, Riverbed sediment, Lithology, The Naruse river,Miyagi prefecture

 

# Relationship between fan area and catchment area for small fans in Japan

*Tomohiro Takaba[1], Hidetsugu Yoshida[2]

1. Depertment of Geography, Graduate School of Arts and Letters, Meiji University, 2. Depertment of Geography, Meiji University

Numerous alluvial fans are distributed in the tectonically active and intensely denuded Japanese Islands. Large fans are formed mainly by fluvial processes. Their spatial distribution and geomorphic development have been comprehensively investigated by several studies (e.g. Saito, 1982; Saito, 1988; Saito and Oguchi, 2005). On the other hand, there have been comparatively fewer studies on small fans, especially on their significance towards long-term geomorphic development. This study deals with small fans in Japan that are substantially developed by debris flows. The target fans are those in the whole of Japan (503 fans in 15 regions); about 7 $km^2$ at the maximum, many of them are less than 2 $km^2$ in $A_f$. The relationship between the fan area ($A_f$) and its corresponding catchment area ($A_d$) is expressed by a regression formula as $A_d=cA_f^n$. Both coefficient values c and n are discussed here. The results are briefly summarized as follows.

1) Depositional processes
There is no distinct difference in values of the intercept coefficient (c), regardless of the depositional processes that developed the fans (fluvial: 0.26 and debris flow: 0.30). However, with regard to the slope coefficient (n), debris flow fans have much larger values (fluvial: 0.66 and debris flow: 0.87). A similar case is seen in the Kofu basin in the previous studies but with much fewer samples (Nakayama and Takagi, 1987). The debris flow is more likely to carry sediment effectively to downstream areas from the fan apex, possibly resulting in the higher “rate” of increase in $A_f$.
2) Active faults at the foot of the mountains
There is still no clear difference in the values of n (presence: 0.84 and absence: 0.80). However, the values of c differ significantly. Where active faults are present, the value of c is 3–4 times larger (presence: 0.30 and absence: 0.09) than its value when active faults are absent. This suggests that $A_f$ increases by the acceleration of sediment supply from the catchments due to the temporal devastation that is caused by episodic seismic motion.
3) Periglacial environment during the last glacial period
The development of small fans is unlikely to be influenced by the existence of periglacial environment in the catchments.
4) Catchment geology
Values of both c and n are larger for fans with plutonic rocks in their catchments and smaller for fans with metamorphic rocks in their catchments. These results are similar to those obtained in the southwestern part of the United States (Hooke, 1968; Lecce, 1991).

Keywords: Small Fans, Ad/Af, Depositional Process, Active Faults, Catchment Geology

 

# Reexamination of the mainstream riverbed height during the Last Glacial period at the narrow pass of the Ara River, connecting Chichibu Basin and Kanto Plain, central Japan

*Takayuki Takahashi[1], Toshihiko Sugai[1]

1. Graduate School of Frontier Sciences, The University of Tokyo

Along the upper river reaches in the northeastern and central Japan, valley filling occurred during the Last Glacial period. Generally, numerous steep tributaries join the mainstream in the upper reaches. Therefore, for reconstruction of the river profile changes along glacial-interglacial cycles, it is necessary to consider the effect of the sediment supply from tributaries. Takahashi and Sugai (2016) reexamined the origin of the filltop terrace formed in the Last Glacial period in the upper reaches of the Tama River, and indicated that the filltop terrace is toe-cut terrace (tributary fans truncated by the lateral erosion of the mainstream; Larson et al., 2015) and that the height of the filltop terrace is 7 to 23 m higher than that of the mainstream riverbed during the Last Glacial period. Similarly to the Tama River, it is necessary to identify toe-cut terraces at the rivers in the northeastern and central Japan and to reexamine the river profile changes of the mainstream during the Last Glacial.

Several fluvial terraces are distributed along the Ara River, central Japan. Yanagida et al. (1982) and Yoshinaga and Miyadera (1986) discussed the development of these fluvial terraces and the river profile changes since the Last Interglacial period although the effect of tributary confluence has not been considered enough. The narrow pass between Minano and Yorii is the key segment for understanding the relationship of fluvial terrace development between the Chichibu Basin and the Western part of Kanto Plain, the height of the mainstream riverbed during the Last Glacial period in this segment has not been clarified enough. Based on the classification of the fluvial terraces in the narrow pass of the Ara River, this study suggests that the two filltop terraces are toe-cut terraces, and indicates the necessity to reexamine the river profile changes of the Ara River during the Last Glacial.

Fluvial terraces in the narrow pass of the Ara River are classified into Oyabana (Ob), Kagemori (Km), and Onohara (On) terrace levels (Yoshinaga and Miyadera, 1986). Ob and Km terraces are filltop terraces with thick gravel beds, On terrace is a strath terrace with thin gravel bed. Ob and Km terraces are distributed around tributary junctions and have gentle slope toward the mainstream. Sharp scarps separate these terraces and On terrace. These topological characteristics suggest that Ob and Km terraces are toe-cut terraces and are not the mainstream riverbed during the Last Glacial period.

The height of the mainstream riverbed can be estimated from extending the cross-sectional profiles of On and Km terrace surfaces toward the mainstream. The profile of the mainstream riverbed during the Last Glacial period converges with that of On terrace toward upstream. Yanagida et al. (1982) suggested that Ob and Km terraces converge with On terrace toward upstream and that the incision due to sea-level lowering migrated toward upstream because Ob and Km terraces are continue to Kushibiki (MIS 5a to 5c) and Yorii (MIS 3) terraces downstream (Yanagida et al., 1982). Yoshinaga and Miyadera (1986), in contrast, suggested that the profile of Ob terrace do not converge with On terrace. Whether the Ob and Km terraces are toe-cut terraces or not is important to reconstruct the profile of the mainstream riverbed during the Last Glacial period. This presentation reports the river profile changes during the Last Glacial period based on chronological and sedimentological analysis of the terrace deposits.

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Keywords: fluvial terrace, Ara River, river profile, Last Glacial, tributary, Toe-cut terrace

 

# Human-disturbed topography formed by past charcoal production in valley-head hollows in the Ohmatsuzawa Hills, Sendai, northeastern Japan

*KIYOSHI SAIJO[1], Takahisa Furuichi[2]

1. Miyagi University of Education, 2. Graduate School of Agriculture, Hokkaido University

Charcoal production had been a major traditional forest use in the hilly areas of Japan before the late 1950’s when common fuel drastically changed from firewood or charcoal to fossil fuel. Even though charcoal production in Japan ceased about half a century ago, we can still recognize many remnants of man-made topography related to past charcoal production (“human-disturbed topography” in below) in the hills. Such topography is expected to be significant evidence suggesting relationship between physical environment and human activity in charcoal production. This study evaluates the effects of the past charcoal production on geomorphological processes in hills on the basis of the characteristics of human-disturbed topography. The study area is the Ohmatsuzawa Hills located between the Naruse and Yoshida River lowlands, about 25 km north of Sendai, northeastern Japan.

A few kinds of human-disturbed topography are distributed at two valley heads. The area and relief of the topography are about maximum 50 square meter and less than 2 meters respectively, which are widely smaller than those of natural micro-landforms composing the valley heads. Although humus layer is lacking in the soil profile on the human-disturbed topography, the A-horizon of over 10 centimeters thick, containing less inorganic material and charcoal fragments, is developed in the downslope.
The characteristics of the human-disturbed topography indicate that the activity for charcoal production in a valley head have neither caused remarkable changes on natural micro-landforms nor accelerated surficial slope processes.

Keywords: charcoal production, artificial topography, valley head, hill

 

# DEM-based Comparative analysis of terrain with gullies on Mars and in Svalbard.

*Jaeyong Lee[1], Takashi Oguchi [2]

1. Department of Environmental Studies, Graduate School of Frontier Sciences, The University of Tokyo, 2. Center for Spatial Information Science, The University of Tokyo

Recently some researchers confirmed the existence of ice and underground water on Mars. Gullies are terrain features that are considered to have been generated by liquids. On Earth, gullies are formed by water, but concerning those on Mars, there is no sufficient evidence of water flow. In some areas on Mars, seasonal streaks called Recurring Slope Lineae (RSL) can be clearly observed in summer but disappear in winter. In addition, some water on Mars was found to be saline very recently, but there are many questions about the origin of water. The issue of water on Mars is important for future possible settlement or terraforming. A related issue is that in areas where gullies and RSL are found, ice such as glaciers exist or existed. Therefore, production of these landforms might be related to glaciers or rock glaciers. In order to address this hypothesis, this paper analyzes the development process of the gullies distributed in Svalbard on Earth, and compares gullies on Mars and Earth.

Keywords: Gully, Mars, Svalbard, Glacier

 