Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HDS25-01 Room:101A Time:May 28 09:00-09:15

The Madi River flood events due to glacial-ice avalanches from Mt. Lamjung, Annapurna

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Two flood events occurred in 2003 in Madi river, southeastern basin of the Annapurna massif. These events have been listed by previous study as the latest event of glacial lake outburst flood (GLOF) in the Nepal Himalayas. According to checking satellite images and field survey, this flood is not GLOF phenomenon but rather glacial-ice avalanche induced flood. Because, a glacial lake which was suspected as the breached lake was actually appeared from 2005 to 2008. The present outlet condition of the glacial lake also has not braked channel which is a evidence of GLOF event in the past. Furthermore, a devastated river bed leading out of the avalanched valley (eastern branch) was confirmed in field survey in 2014.

In this presentation, we will also make mention following result and recommendation,

- In the Nepal Himalayas, GLOF from moraine-dammed lake, which is one of the typical disaster in the asian wet-tectonic zone will be not frequent disaster in future.
- Multiple caution and monitoring for the flood from glacial ice avalanche due to glacial snout calving and water body rupture in debris-covered glacier are required.

Keywords: glacier snout calving, GLOF, global warming, satellite image, Nepal, Himalaya Mountains

Japan Geoscience Union Meeting 2015
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HDS25-02 Room:101A Time:May 28 09:15-09:30

Dammed-lake sediments caused by the Shichimen-zan landslide in the late Heian period, Southern Japanese Alps

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The Shichimen-zan landslide (SMZ) is a large bedrock slide occurred on the east side of Mount Shichimen-zan in Southern Japanese Alps (35.3704N, 138.3504E, 1983 m ASL). Geology of the SMZ is mainly composed of late Eocene to early Miocene west-dipping sedimentary rocks. A previous study revealed that the SMZ was already present in 1600s by analyzing the local historical documents. However, the timing of onset and landscape evolution of the SMZ have not been exactly known. For better understanding of geomorphological and geological development of large-scale landslide like the SMZ, the author investigated the local geology in and around the SMZ. Consequently, lacustrine sediments composed of fines with standing trunk of trees near the toe area of the SMZ. Three radiocarbon ages of wood fragments in the lacustrine sediments (L1 and L2) and debris flow deposits (D1) which cover the lacustrine sediments indicated cal AD 1057-1075, 1153-1225 and 1231-1245 (L1), cal AD 1034-1164 (L2), and cal AD 1438-1514 and 1598-1618 (D1), respectively. These ages show that a dammed lake had been present around AD 1055-1160 (as the late Heian period in Japanese history). This paleolake would have been formed by channel blocking associated with an ancient large landslide of SMZ. Later, a debris flow event occurred. Although a trigger of the large landslide of SMZ is uncertain at present, the AD1096 mega-earthquake generated from the Suruga-Nankai troughs is possible.

Keywords: Large-scale bedrock landslide, Landslide dam, Plant macro fossils, 14C age, Eicho earthquake

Japan Geoscience Union Meeting 2015
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HDS25-03 Room:101A Time:May 28 09:30-09:45

Lithology and age of sediments accumulated in linear depressions on the Nagakabe Ridge in Kamikochi, Japanese Alps

KOJIMA, Satoru[1*] ; NAGATA, Hidehisa[2] ; HASEGAWA, Yoshiyuki[1] ; IWAMOTO, Naoya[1] ; KOMURA, Keitaro[3] ; KANEDA, Heitaro[3] ; OHTANI, Tomoyuki[1]

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There are many double ridged on the Nagakabe Ridge extending from Tokusaka to Chogatake Mountain, northeast of Kamikochi, southern Japanese Alps; most of them are interpreted as the deep-seated gravitational slope deformation features. In order to reveal the development history of these geomorphic features, the sediments accumulated in the linear depressions between the ridges were drilled by the hand auger boring, and the lithology were described and the ages were estimated. The drill sites are located along the climbing trail about 2000 m (Point A) and 2050 m (Point B) above sea level, and are surrounded by conifer trees. The sited are on the flat surfaces between the multiple ridges, and nine cores 80-160 cm long were obtained. The sediments are composed of the upper part of carbonaceous mud and the lower part of yellowish-brown silt (pebbly in part), between which is the gray mud-silt; the thickness of these sediments are variable from site to site. The fraction of 62-200 micro meters of the sediments are composed of volcanic glass and crystal, clastic material, and plant fragment. The volcanic glasses are the mixture of bubble wall-type and pumice-type glasses. The core GUNK-7 from Point A, ca 160 cm long, starts to include bubble wall-type glasses from the depth of 87-92 cm, and for the core GUNK-2 from Point B, ca 150 cm long, the depth is 62-72 cm. The values of refractive index of these volcanic glasses are scattered around 1.510, and are coincide with those of Kikai Akahoya tephra about 7300 cal BP. We will also report the AMS 14C ages of plants included in the sediments.

Keywords: deep seated gravitational slope deformation, double ridge, Nagakabe ridge, Kamikochi

Japan Geoscience Union Meeting 2015
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HDS25-04 Room:101A Time:May 28 09:45-10:00

Preliminary study on formative factor of uphill facing scarplets based on bell-shape index of high relief mountains

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Double ridges or up-hill facing scarplets distributed on mountain ridge in high relief are known as indicators that mountain bodies are undergoing gravitational creep deformation and as signs of landslide in large scale.

Mountain ridges in northern part of Hida Range (Northern Japan Alps) show gentle and round and are fringed by distinct break of slopes. Mountain profiles of high contrast between steep lower slope and gentle ridge ridge tops are similar to a bell-shaped mountains of high relief. In another word, the bell-shaped profile is one kind of the convexity in ridge profiles. The authors think this index is a good marker of gravitational rock creep and a subsequent deformation of mountains. However, there sometimes develop up-hill facing scarplets on low convexity slope in that area. This study tries to consider contribution of strike slip faults as to the formation of up-hill facing scarps on such slopes.

Keywords: gravitational deformation, bell-shape index, high relief mountain, strike slip active fault

Japan Geoscience Union Meeting 2015
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HDS25-05 Room:101A Time:May 28 10:00-10:15

Long-traveling landslide on snow: a case of Daimyojin-sawa, upper course of Katakaigawa River, Toyama Prefecture, Japan

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[1]Fu Sui Do Co., Ltd., [2]KANSO Technos Co., Ltd., [3]Toyama Univ.

Long-travelling landslide on the snow occurred in the spring of 2014 was described. The source area of the landslide is located at near the head of Daimyojin-sawa, upper course of Katakaigawa River. Precise date of occurrence is unknown because the locality is in the deep mountainous area, so that the trigger is also uncertain. However, it may not be by earthquake, but by rainfall with snow melting.

Interpreted by airphoto, the dimensions of the source area are approximate 65 m in width and 160 m in length. The inferred volume of the landslide reaches 100,000 m^3. Geology of the bedrock is Jurassic Funatsu Granites.

The landside debris flowed down along the Daimyojin-sawa with 35 degrees incline and were deposited on the snow with 0.2-0.5 m thick. The travelling distance is 2.4 km, and relative height is 980 m, namely, the equivalent friction coefficient (H/L) becomes 0.41.

The landslides slid on the snow are composed of various materials such as mixture of water, snow and rock fragment. The mobility of the landslides depends on the materials as well as topography.

Keywords: landslide, long-travelling, snow, Toyama

Japan Geoscience Union Meeting 2015
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HDS25-06 Room:101A Time:May 28 10:15-10:30

Detection of landslide triggered by 2014 North Nagano Prefecture earthquake using ALOS-2/PALSAR-2 InSAR image

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InSAR image was produced from HH-polarized ALOS-2/PALSAR-2 data measured on 2 Oct 2014 and 27 Nov 2014, then superimposed by landslide distribution map (National Institute for Earth Science and Disaster, 2000). As a result, it was difficult to identify the surface deformation of Happo-iwa landslide and Kakurezawa landslide (Komatsubara et al., 2015) triggered by 2014 North Nagano Prefecture earthquake; however, the image inferred the subtle amount of deformation on no-landslide slope near Shimizu-yama.

Acknowledgement
Software RINC 0.27 developed by Dr.Ozawa, National Institute for Earth Science and Disaster was used in producing InSAR image.

References

Komatsubara et al., 2015, Landslide in Nakaya district, Otari Village and lateral spread in Horinouchi district, Hakuba Village triggered by North Nagano Prefecture earthquake (M=6.7) on 22 Nov 2014, Journal of the Japan Landslide Society (in press).
National Institute for Earth Science and Disaster Prevention, 2000, landslide distribution map database.
Ozawa T, 2014, Development of InSAR analysis tool in National Institute for Earth Science and Disaster Prevention (series 3), JPGU2014, STT59-P12.

Keywords: earthquake, landslide, SAR, ALOS-2, PALSAR-2

Japan Geoscience Union Meeting 2015
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HDS25-07 Room:101A Time:May 28 10:30-10:45

Landslide occurrences and recurrence intervals of heavy rainfalls in Japan

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Rainfall-induced landslides frequently occur in the Japanese archipelago. Radar-Raingauge Analyzed Precipitation has been operated by Japan Meteorological Agency since 1988. These rainfall data is useful for understanding the relation between landslide occurrences and the rainfall conditions. This study developed the probable rainfall database across Japan and analyzed the potential correlation between the landslide magnitude-frequency and the recurrence interval of the heavy rainfall. We analyzed 4,744 rainfall-induced landslides (Saito et al., 2014, Geology), and the rainfall intensity (mm/h), cumulative rainfall (mm), and soil water index (SWI). We then estimated recurrence intervals for these parameters using a Gumbel distribution with jackknife fitting. Results show that the recurrence intervals of SWI which caused landslides ($<10^3$ m^3) are less than 10 yr across Japan. The recurrence intervals increased with increases in landslide volumes. With regard to the landslides larger than 10^6 m^3, recurrence intervals of the rainfall events are more than 100 yr. These results suggest that recurrence intervals of heavy rainfalls are important for assessing regional landslide hazard in Japan.

Saito, H., Korup, O., Uchida, T., Hayashi, S., and Oguchi, T., 2014. Rainfall conditions, typhoon frequency, and contemporary landslide erosion in Japan. Geology 42, 999-1002.

Keywords: landslides, magnitude-frequency, recurrence intervals of heavy rainfalls, Radar-Raingauge Analyzed Precipitation

Japan Geoscience Union Meeting 2015
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HDS25-08 Room:101A Time:May 28 11:00-11:15

Prolonged Changes in Sediment Discharge after Large Sediment Yield Events

YAMASHIRO, Kenta[1*] ; OKAMURA, Seiji[1] ; HIDA, Yoshihisa[1] ; HORIE, Katsuya[1] ; MATSUMOTO, Naoki[2] ; NIWA, Satoshi[2] ; UCHIDA, Taro[2] ; KANBARA, Junichi[2]

[1]IDEA Consultants, [2]National Institute for Land and Infrastructure Management

Much large-scale landslide disaster has happened in Japan up to now.

They are caused by a natural phenomenon of an earthquake and a torrential rain.

It is important to consider the period of several years after large-scale sediment production by collapse such as deep-seated landslide, in terms of management of basin-sediment discharge and making arrangements to deal with the emergency for large-scale sediment disaster.

There are studies for grasping actual condition of sediment discharge after large-scale sediment production in these days.

However, it is not clear that how sediment discharge after large-scale sediment production changes with age, and that what has an effect on the sediment discharge.

In this study, we researched about nine different basins where large-scale sediment disaster such as deep-seated landslide occurred, organized information about actual condition of sediment discharge after large-scale sediment production, and analyzed that what effects on sediment discharge.

In this study, we adopted two estimation method of the sediment production described to below.

(1) We estimated landslide area by interpretation of aerial photograph taken before and after large-scale sediment disaster, and applied Guzzetti formula for each landslide area. In doing so, we could estimate sediment discharge volume from landslide area.

(2) We regarded the average of the difference of aerial laser profiler at two shooting date and time as the landslide depth, and estimated sediment discharge volume by multiplying landslide area by one.

We estimated sediment yield by setting up the value that we added microscope sand such as wash load to sediment storage in dam.

We could estimate sediment discharge volume from landslide area

We estimated sediment discharge volume with age, and analyzed a change of sediment yield after large-scale sediment production. Thorough the analysis of change of sediment production and sediment yield with age in different basins, we could compared and analyzed the effects (such as an earthquake, a torrential rain and the amount of precipitation) on sediment discharge after large-scale sediment production.

Keywords: sediment discharge, landslide, landslide dam

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HDS25-09 Room:101A Time:May 28 11:15-11:30

Relations of urbanization and the suffering of the alluvion drill,on large debris disaster of Hiroshima

KOBAYASHI, Hiroshi[1*] ; MIURA, Hiroyuki[1] ; AKIYAMA, Yukihide[1] ; SHIBUYA, Kennichi[1] ; NAGANO, Eiji[1]

[1]Aero Asahi Corporation

By the large-scale debris flow disaster in Hiroshima-City that occurred on the early morning of August 20, 2014, a lot of debris flows occurred for all-at-onceness from the steep mountainous district near plains and overflowed in the residential area of slope of diminishing gradient which was formed to border the foot of a mountain that faced it mainly along the valley of the lower Otagawa region and brought big damage.Hiroshima region has little level ground, and a mountainous district with Chugoku district special constant height spreads out. Steep terrain of relative height 300m - 700m approaches the level ground, and slope of diminishing gradient of 3 degrees - 20 degrees is formed at the exit of many valleys flowing down from the mountainous district a slant. In the Hiroshima suburbs lacking in the level ground, this slope of diminishing gradient is developed flourishingly as a residential land.However, according to the exact topography model that it made by a model laser profiler mounted with a plane after a disaster, as for most of slope of diminishing gradient, it became clear to be the alluvion drill which the development of the bench was formed from the extremely fresh sedimentation side that it had little. As for this,slope of diminishing gradient is the place where accumulating continues now; of the mud flood flow down; and suggest that sedimentation occurs frequently. In fact, of the mud flood by this disaster that Japan Society of Erosion Control Engineering made flowed down, and a slant overlapped with the range of 3 degrees - 20 degrees, and, in the sedimentation range, a lot of of the place that occurred of the victim was almost slope of diminishing gradient more than slant 7 degrees that the valley exit was near again. In addition, a mean incline between the style inferior segment of the mud flood matches that a mud flood sedimentation section is said more than 3 degrees more than 10 degrees.In Hiroshima District, I suffer big damage in a residential area developed by the large-scale earth and sand disasters that occurred on June 29, 1999 in the similar topography ground in the past. Therefore, using base map information numerical value topography model, a slant around Hiroshima-City extracted the domain of less than 20 degrees more than 3 degrees. As a result, in slope of diminishing gradient formed by the alluvion drill top and creation over a wide area in the city, a slant was able to extract domains more than under 15 degrees, 15 degrees more than less than 10 degrees, 10 degrees more than 3 degrees. After repeating a population concentration area in these domains, it was wide, and, on a slope having a slant equivalent to a mud flood sedimentation section between the mud flood style inferior segment in the Hiroshima-City suburbs, it was confirmed some other time that development advanced.

Keywords: debris flow, alluvial cone, urbanization, disaster risk

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HDS25-P01 Room:Convention Hall Time:May 27 18:15-19:30

Origin of hummock swarm developed in Kamenoharaike landslide of Oki Dogo, Shimane Prefecture

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In the Tsuma district, Okinoshima-town located in the southwestern part of Oki Dogo, several landslides, occurred in Omosu Formation mainly of trachyte and rhyolite lava interbedded rhyolitic tuff, are characterized by swarm of elongated, rounded hillocks around small valleys .

Our investigated Kamenoharaike landslide is one of them and has a triangle shaped moving body which is about 2.5km long to the toe and maximum 2.0 km wide at the main scarp. From the topography of the moving body it estimates that the dip angle of sliding surface is approximately less than 5 degrees.

At Kamenoharaike landslide we found many hillocks consisting of jointed hard lava of trachyte or rhyolite, and some outcrops of soft clayey rhyolitic tuff underlying the lava with high water content. This two-storied house structure suggests existence of cap rock structure of upper hard layer of trachyte or rhyolite lava and lower soft layer of rhyolitic tuff before slope movement.

Interpretation of landslide landform used for topographic map at a scale of 1:25000 and aerial photographs at a scale of 1:10000 has revealed that the moving body of Kamenoharaike landslide is separated from about 30 hummocks many of which are arranged parallel or sub-parallel to the main scarp. The hummocks has a range from 50 to 500m in length and from 20 to 200m in width, and the top of hillock rises from 10 to 80 from the level of valley bottom. The aerial shape shows a lozenge, oval and parallel-tetragon. The existence of hummock swarm and their arrangement pattern coincide with topographic features of spread (one of movement type of landslides) demonstrated by Oyagi(2003).

Mountain area behind the main scarp is developed in deep linear depressions, suggesting existence of open cracks, parallel and sub-parallel to the directions of elongated hummocks in the moving body. From this fact, it is possible that formation of the linear depressions is prior to movement of spread over the area of Kamenoharaike landslide. However as the two linear depressions of east -west and the southwestern-northeast trend divide the main scarp into three segments, the linear depressions have been active after the formation of the main scarp of Kamennonaraike landslide

Keywords: Oki Dogo, Landslide topography, Spread

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HDS25-P02 Room:Convention Hall Time:May 27 18:15-19:30

Late Pleistocene to Holocene landslide dammed lakes formed around Lake Shibire, Misaka Mountains, central Japan

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At 2014 JpGU meeting, we preliminary reported the historical development of Lake Shibire based on the geological and geomorphological information (Suzuki *et al.* 2014; HDS29-P06). In particular, we showed the sedimentological and chronological features of a paleolake (paleolake A; PLA) that was connected with the present Lake Shibire and had survived during the period from 47 to 30 cal ka. At 2015 JpGU, we account for new ^{14}C dates of the lacustrine sediments of PLA, and for the newly discovered lacustrine sediments formed by another paleolake.

New ^{14}C samples were obtained from the middle and the uppermost positions of PLA sediments, whereas the bottom age of PLA sediments was already decided as 47-46 cal ka. These samples indicated 42-41 cal ka and 3.1-3.0 cal ka, respectively. We should pay careful attention to unconformity (unidentified at present) between the middle and upper parts of PLA sediments. However, it can be estimated that PLA had survived for longer than ever thought. In the late Holocene, PLA would have shrunk and had landscape of wetland or gradual channel.

Other lacustrine sediments were found from the outcrop localities about 1 km south of the present Lake Shibire. These sediments continue horizontally and can be observed at least four outcrop localities at the same altitude (700 m ALS). This altitudinal concentration of these sediments is obviously different from that of PLA sediments. Judging from these facts, we consider that these sediments were formed by another paleolake (paleolake B; PLB). Although the age and total thickness of PLB sediments are uncertain at present, the estimated area of PLB is 0.05 km^2. Our geomorphic analysis suggests that PLB was caused by the secondary landslide generated from the primary landslide body that created the paleo Lake Shibire and PLA.

Furthermore, we will attempt to show the preliminary description for drilling cores being recovered (as of Feb. 2015) from a lacustrine terrace along the present Lake Shibire.

Keywords: landslide, dammed lake, lacustrine sediments, 14C date, late Pleistcene

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HDS25-P03 Room:Convention Hall Time:May 27 18:15-19:30

Landslides in Aoki Village, Nagano Pref., Japan : Their distribution and geological-geomorphological characteristics

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[1]Undergraduate at Senshu University., [2]Senshu University., [3]Tokyo Metropolitan University.

Many landslides are present in the Aoki Village of Nagano Prefecture where the Neogene sedimentary rocks and rugged mountains are dominant. Nevertheless, little attention has been paid to the distribution, topographies, and ages of landslides in this village. We investigated the landslide geology and geomorphology of the village on the basis of airphoto interpretation, field mapping of geology, and tephrochronology of landslides as well as GIS-aided geomorphic analysis.

A sum of 109 landslides was identified. A total area of those landslides attains 12.3 km^2, occupying 21.5% to the total area of the village. Six landslide complexes comprising an assemblage of landslide bodies were also distinguished. Landslide distribution generally coincides with lithology of bedrocks. In particular, cleavable the Bessho Formation of shale seems to be prone to landslide occurrence. A cap rock structure and dip-slope strata are also thought to be crucial factors. These suggest that rock control is effective to generate landslides in the study area.

We found faulted and folded tephra layers with high content of hornblende, quartz, and biotite covering the Irinaramoto Landslide Complex (INM) that is a widest and most typical landslide in the village. Stratigraphic position and mineralogical properties of these tephra beds suggest that these tephra layers can be correlated with the Omachi APm during 350-300 ka. This fact shows that the primary or secondary landsliding of the INM would occur after the middle Pleistocene despite their triggers are uncertain.

Keywords: Neogene system, Tephrochronology, Omachi APm tephra group, Cap rock, Rock control, Dip slope landslide

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HDS25-P04 Room:Convention Hall Time:May 27 18:15-19:30

Geomorphic and geologic features of the Holocene catastrophic rock avalanche in Yabusawa Valley, Akaishi Range, Japan

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[1]Graduate School of Senshu University, [2]Senshu University, [3]Kyoto University, [4]University of Tokyo

To determine the cause and age of thick gravel layers called the Yabusawa Gravel (YG) in the northern face of Mount Senjo (3033 m ASL), we reinvestigated geology and geomorphology of the YG. Although the previous authors considered that the YG was of glaciofluvial or of landslide origin, there is no clear consensus as to the origin and age of the YG.

The YG consists of poorly-sorted thick angular clasts of sand stone, mud stone, and hornfels, forming a geomorphic feature like fluvial terraces along Yabusawa Valley. On the outcrop walls of the YG, rock clasts clearly exhibit jigsaw crack structures, although specific sedimentary facies reflecting fluvial processes such as lamination and imbrication are not observed at all. A lithotype of rock clasts in the YG is almost restricted to single geology at a given outcrop locality. Surficial topography of the YG has hummocks and levee-like terrain. A mountain ridge and valley side slopes adjacent to the YG have ridge-top linear depressions, untiscarps, and valley bulging, suggesting deep-seated gravitational slope deformation. Terrestrial cosmogenic nuclide dating of sandstone fragments obtained from three localities on the depositional surfaces of the YG shows 10.3-8.4 ka, 10.0-8.1 ka, and 9.4-7.6 ka (in ^{10}Be scale). On the basis of these facts, we concluded that the YG was produced by catastrophic rock avalanche (rock slide) in the early Holocene. The previous authors emphasized degradation of mountain permafrost for landslide occurrence, we invite attention to paleoearthquakes caused by nearby active faults or convergent plate margins as well as early Holocene pluvial climate and long-term gravitational rock deformation.

Keywords: Rock avalanche, Deep-seated gravitational slope deformation, Terrestrial cosmogenic nuclide dating, Holocene

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HDS25-P05 Room:Convention Hall Time:May 27 18:15-19:30

The Relationship between the Development of Slip Surfaces and Small Scarps on Deep-Seated Catastrophic Landslides

YOKOYAMA, Osamu[1*] ; OGAWAUCHI, Yoshito[1] ; YAMAZAKI, Tsutomu[1] ; SAKURAI, Wataru[2] ; SAKAI, Ryo[2] ; OKUYAMA, Yuki[2] ; KITAGAKI, Hirofumi[2] ; HIRANO, Go[3]

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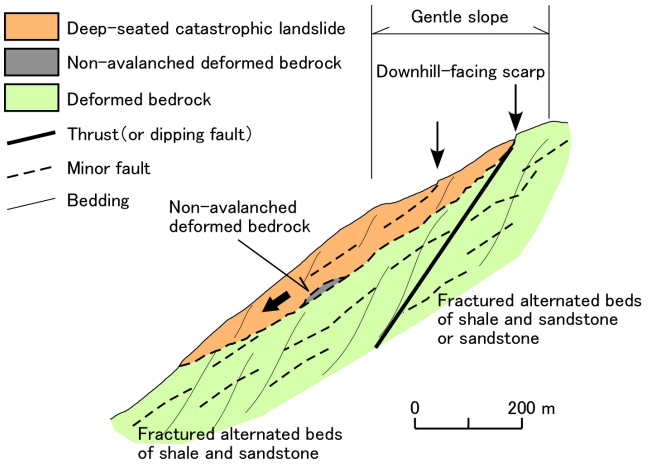
To predict the occurrence of deep-seated catastrophic landslides in advance, it is effective to recognize the surface topography that has preceded the catastrophic landslide. Recently, it has become possible to obtain high-resolution DEMs using the airborne laser scanner survey (LiDAR). However, in areas where mountains have high relief and fractured sedimentary rocks, large-scale gravitational slope deformation proceeds in a wide area, while topography, such as linear depressions and uphill and downhill-facing scarps, becomes sufficiently developed. Thus, in just recognizing deformed topography, it is difficult to identify high risk catastrophic landslides. Therefore, it is necessary to determine the relationship between the internal geological structure and the geometry, and differentiate geomorphological features by standards to predict the location, scale, and occurrence time of catastrophic landslides. In this study, we clarify the geomorphological and geological features of a deep-seated catastrophic landslide (Akadani) that occurred on the Kii Mountain because of heavy rain in 2011. Additionally, we examined the relationship between the slip surface and the small scarp.

It is considered that the shear proceeds in the brittle fracture zone of a minor fault, and that the weak layer of the slip surface is formed in the creeping rock mass. Also, several meters of the small scarp were formed before the catastrophic landslide, and are consistent with the outline of the catastrophic landslide. In fact, the shear plane came out of the ground by concatenating minor faults that were located intermittently in the mass rock. In addition, large scale planar structures, such as a thrust or high-angle fault, controlled the outline of the catastrophic landslide. Kawarabi and Nagatono, adjacent to Akadani, also have many similar points that are made up of the same geomorphological and geological structures.

Keywords: deep-seated catastrophic landslide, slip surface, minor fault, gravitational slope deformation, small scarp, LiDAR



Japan Geoscience Union Meeting 2015
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HDS25-P06 Room:Convention Hall Time:May 27 18:15-19:30

Distribution of trigger and relationship between trigger and geology of deep-seated landslides

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In the Shimanto accretionary complex in the southwest Japan, most of the recent deep-seated landslides (DSLs) were induced by heavy rainfall over 1000 mm in a few days. In contrast, in the areas of Neogene sediments in the northeast Japan, recent DSLs were induced by strong seismic motion larger than six on the Japanese earthquake damage scale. These facts imply that the regional characteristics exist in the factors that induces DSLs (i.e., rainfall or earthquake), and that these factors are related strongly to the geological features of DSL sites. We therefore studied the regional characteristics of rainfall and earthquake on the basis of the distribution maps of rainfall probability, active faults and earthquake epicenters in Japan.

The processes of DSLs induced by two factors and the geological influences on them are summarized as follows. In the Shimanto accretionary complex in the southwest Japan, DSL induced by heavy rainfall is more likely compared with that by earthquake. This is because of the higher precipitation in the relevant area and the convergence of seepage water into the cracks of potential slip surfaces formed by rock creep. Earthquake-induced DSL is unlikely because active faults in this region are few and the mountainous basement is relatively hard. On the other hands, in the Neogene sediments in the northeast Japan, rainfall-induced DSL is unlikely because of the lower precipitation and the divergence of seepage water due to porous media. Earthquake-induced DSL is likely because earthquake stimulates greater ground motion in the Neogene sediments and the mountainous basement is relatively soft.

Keywords: deep-seated landslide, trigger, geology, heavy rainfall, strong earthquake

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Study on developing process of valley by deep-seated catastrophic landslides

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The Typhoon Talas (T1112) induced many large and deep-seated landslides in the Kii Peninsula. The Shimanto group (an accretionary complex) is widely distributed on the Kii Peninsula, and deep-seated landslides are known to occur often in this kind of accretionary complex. Also, many of the deep-seated landslides caused by Typhoon Talas occurred on dip slopes, and it is thought that such geological structures also had a possible factor to the occurrence of deep-seated landslides. However, until now, there was no widely used physical-based model for describing deep-seated landslide rapid (catastrophic) occurrence.

Recently, we have proposed a physical-based model for describing the process of widening water channel that accompanies the overtopping erosion of landslide dams. In the model, we assumed that the channel widening was induced by side slope collapses due to channel bed degradation, and we used slope stability analysis to describe side slope collapse. We confirmed that the proposed model was able to effectively describe the side slope geometry of water channels of actual landslide dams.

We considered that there is the possibility that the development process for valleys that occur with deep-seated landslides can also be describe during our proposed model. Accordingly, in this study, with the deep-seated landslides caused by Typhoon Talas and the slopes where did not occur as our focus, we used the detailed topological data (LiDAR data sets) measured before and after Typhoon Talas to sort bank grades and relative heights, and to evaluate the applicability of the model.

As a result, for areas where geological structures and soil strength were thought to be generally uniform, the relations between gradient and relative height of side slope of Tostugawa River were effectively described by the proposed model. This seems to suggest the possibility of using fundamentally measurable physical values to predict, to a degree, the slopes that are at risk of deep-seated landslides and the scale of those landslides.

Keywords: Deep-seated catastrophic landslides, Slope stability analysis, Soil property, Typhoon Talas (T 1112), Kii peninsula

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Geomorphological and geological features of landslide lobes in the Dakesawa basin, the Kamikochi Valley of Japanese Alps

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The Dakesawa basin is a stream tributary to the Azusa in Kamikochi Valley. It is believed that the whole of Dakesawa basin was formed by the Pleistocene glaciations. However, no direct evidences such as moraines have been found. In the Dakesawa basin, steep valley side slopes with sparse vegetation and wide valley floor with recent debris flow tongues are prominent. The Dakesawa basin is composed of welded tuff, diorite porphyry, and granodiorite. A large lobate form (DLB; 270 m wide, 370 m long, estimated volume 1.9×10^5 m ^{3}) is present in the lowermost part of the Dakesawa basin. DLB is composed of two smaller lobes whose altitudes are different (DLB-h and Dlb-l). DLB seems to continue to a wedge-shaped steep valley head whose geology is restricted to granodiorite. This valley head is situated at a peripheral convex break of gentle slopes with features of deep-seated gravitational deformation. Also DLB is arranged to cover the present debris flow tongues on the valley floor of the Dakesawa basin. Surface of DLB-h and Dlb-l is composed of a pile of megaboulders ($>$2-10 m in diam.) showing block fields with open-work textures. Restrictive lithology of these boulders to granodiorite is obvious. A possible cause of DLB is rockslide that occurred on the nearby valley head. Fallen materials would spread on the valley floor of the Dakesawa basin. Although the age of rockslide is measuring in progress, the Holocene epoch is practical certainty because of its stratigraphic relationships between recent debris flow tongues.

Keywords: Bedrock landslide, Deep-seated gravitational slope deformation, Block field, Holocene

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Development history of concentrated sackung features around northern tip of the active Neodani fault, central Japan

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Suckung features such as linear depressions and up-hill-facing scarps are receiving attention as precursors of deep-seated landslides. Recent high-resolution airborne LiDAR revealed that many sackung features are concentrated around the northern tip of the active Neodani fault, central Japan. These features are hidden under forest canopies, and thus high-precision dating of deformation episodes would be feasible by AMS-^{14}C ages from carbon-rich sediments that fill sackung depressions, which is a big advantage over previous similar studies in alpine areas. In order to examine the relation between the fault activity and the formation of these features, we conducted hand auger coring (down to 1.5-3.4 m depth) and pit excavation (down to 1.5 m depth) at five sites out of ˜20 gravitational depressions that occurred in our study area.

On the basis of AMS-^{14}C ages of leaves, seeds, and twigs collected from peaty and lacustrine sediment as well as results of tephra analysis, it proved that all studied depressions were formed after the last glacial, but the formation ages vary from depression to depression: the oldest one was formed ˜11,000 years ago whereas the youngest one occurred ˜2,000 years ago. In addition, our pit excavations revealed that the sediments are deformed after their deposition, suggesting that some of the sackung scarps grew at least twice after ˜3,600 years ago, and the most recent growth may have occurred associated with the 1891 Nobi earthquake on the Neodani fault. Multiple Holocene events of sackung-scarp formation and growth are consistent with earthquake recurrence interval of the Neodani fault (˜2000-5000 years), so they may have a synchroneity.

Keywords: sagging, sackung, active fault, Mino mountain, AMS-14C ages, tephra analysis

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The mechanism of strain rate strengthening during landslide

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Many landslides slip relatively slowly without catastrophic failure. The slip events happen when sporadic hard rainfall. Monitoring and disaster prevention measures are carried out in some landslide area. These monitoring records must be useful to elucidate landslide mechanism. This study shows detailed slip behaviors at landslide by monitoring records of landslide.

The study area is located in Hiroshima, southwestern Japan. The talus sediments are overlained by the mudstones of the basement rocks. The mudstones include the basal slip fault of the landslide of several centimeters in width. In situ strain and groundwater level were observed in five borehole sites. Ground surface movements were observed by extensometers. The groundwater level increased immediately after beginning of the rainfall, and which trigger the landslide. The acceleration rate of the landslide, decreased with slip velocity. This demonstrates strain rate strengthening.

Keywords: landslide, strain rate strengthening

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Relationship between the wind damage caused by the 1959 Isewan Typhoon and the landslide that occurred afterwards

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We investigated landslides caused by the later rain, on the slopes in the granite where forests were destroyed by typhoon. Investigation area is located in Nagiso town, Nagano Prefecture. In Nagiso town, large-scale forest area was destroyed by the Isewan Typhoon in 1959. First, we interpreted aerial photographs been filmed immediately after the typhoon and extracted wind damage zone. Second, we interpreted plural aerial photographs been filmed after the typhoon and extracted landslides occurred by the later rain. And then, we examined the relationship between forest damage zone by the typhoon and landslides by the later rain, in conjunction with the topographic condition.

As a result, it was revealed that a lot of landslides occurred on the forest slope where the typhoon was damaged. Furthermore, it was recognized that the slope where landslides occurred was tendency to gentle and southfacing.

Keywords: Isewan Typhoon, wind damage zone, landslide, aerial photointerpretation, granite rock

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Detection the landslide deformation using InSAR analysis in the southern Japanese Alps

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It is important to identify the ground deformation areas by landslides for sediment disaster prevention. Since InSAR analysis can investigate surface deformation in wide areas with accuracy of centimeters, it is effective for detecting on actively creeping landslides. Aim of this study is detecting deformation of landslides using ALOS-PALSAR data and verifying the validity of results based on the field survey. We conducted InSAR analysis in the Ikawa district located in the southern Japanese Alps, central Japan. This area has weak geology because of fault belts named Median tectonic line and Itoigawa-Shizuoka tectonic line. A lot of landslides have occurred due to existing steep topography and abundant precipitation (about 3100 mm/year). We compared the results with landslide distribution maps that were constructed by aerial photograph investigations detecting characteristic landslide topographies. As a result, by the InSAR analysis, some displacements of landslide bodies were extracted. We detected clacks in road retaining walls by field survey at displacement points. We also conducted 2.5-dimensional analysis at the areas in which displacement has been observed using images captured on both ascending and descending orbits.

Keywords: landslide, InSAR

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About a large-scale landslide disaster of Hiroshima by the Airbone Lidar

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In a large-scale debris flow disaster stricken area in Hiroshima-City that occurred on the early morning of August 20, 2014, I carried out an aviation laser measurement and considered the characteristic of the mountain stream which produced the topography, a geological feature and a mud flood.The southwestern part was the sedimentary rock distribution area that rough grain - infinitesimal grain granite distribution area, the northeast side made a hornfels, and it became clear depending on geological feature distribution in the detailed topography model in Yagi, the Midorii district in investigation places that valley density, the relative height distribution of the basin were different clearly. Similarly, in the Kabehigashi district, middle grain - infinitesimal grain granite distribution area, the eastern part were Takada rhyolite distribution area the western part, and valley density, the relative height distribution of the basin were different depending on geological feature distribution clearly. Furthermore, it was revealed that a real geological feature border was different from existing geologic map width (product research institute), but was able to estimate it from a characteristic of the topography.The sections of a slow incline continued in the whole in the granite distribution area of Yagi, the Midorii district when I compared the longitudinal section shape of the mountain stream in each geological feature distribution area, and only the most upper reaches region where the basin world was near became the steep grade. On the other hand, an incline changed in the whole exponentially in the hornfels distribution area. Is the down stream from the neighborhood of valley exit; as for neither of the mud flood knew that flowed down, and sedimentation section considerable inclines continued for a long time.After all, in the Kabehigashi district, the sections of the incline that the middle down stream part was gentle continued with the granite distribution level, but the most upper reaches region was a steep grade very much. On the other hand, in the rhyolite distribution area, I showed a characteristic like the hornfels distribution area. Is the down stream from the neighborhood of valley exit; as for neither of the mud flood flowed down, and had a long it, and sedimentation section considerable inclines continued, but tended to be slightly in comparison with Yagi, Midorii district loose.At each mountain stream, it reflects that an alluvion drill develops from the neighborhood of valley exit that an incline of the down stream side is slow. In addition, at the mountain stream which faced Otagawa of the district at the north end directly in Yagi, Midorii districts, I show a constant sudden vertical section incline, but, as for this, the end receives erosion of Otagawa, and it is thought that I am connected with having been the environment that cannot form an alluvion drill.The above-mentioned mountain stream properties are greatly related to the production situation of the earth and sand, the transportation situation, the sedimentation situation in this disaster.

Keywords: granite, hornfels, rhyolite, longitudial profile of ravine, debris flow

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Soil structure and shallow landslides on hillslopes underlain by granite and hornfels

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In 22 August 2014, a heavy rainstorm triggered numerous shallow landslides and debris flows in hillslopes of granite and hornfels in Hiroshima, southwest Japan. The landslide density was larger in granite area than in hornfels area even they received almost same rainfall amount (˜150 mm/3h). Soil thickness on hornfels was thicker than that on granite. We investigated hillslope with shallow landslides to understand the difference in soil layer structure and soil properties. In the granite area, hydraulic conductivity ranged 10^{-5}-10^{-2} cm/s, decreasing gradually with increasing soil depth. In the hornfels area, hydraulic conductivity ranged 10^{-8}-10^{-4} cm/s and impermeable layer emerged just below the slip surface. These results suggest that soil properties are different between granite and hornfels. The soil from hornfels contains finer in grain size, higher in clay and more cohesive minerals than that from granite. These differences may affect the subsurface water behavior and slope destabilization process in each area, and hence potential of shallow landsliding by heavy rainstorms.

Keywords: shallow landslides, granite, hornfels, soil stracture

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The analysis of relation between scale and topography on landslides induced by earthquake

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The scale and volumes of deep-seated catastrophic landslide are often very large. And the damage by deep-seated catastrophic landslide is also often much. To reduce these hazards requires to estimate the place that deep-seated catastrophic landslides occur. On landslide induced by earthquake, Uchida et al.(2004) showed that the formula consisting of topographic features and seismic motion is useful to extract the small landslide. Takezawa et al.(2013) selected slope relief as scale of slope. And this article indicated that landslide susceptibility was confirmed by using slope relief. In addition, Sammori et al.(2012) suggested that landslides induced by Iwate-Miyagi Inland earthquake were controlled by not only topography, but also geology and the distance between landslides and earthquake fault. However few studies investigated the effect of geology, the positional relation with landslide and earthquake fault, and topography on the scale and density of landslide induced by earthquake, especially the difference between deep-seated catastrophic landslide and shallow landslide. From the above in this study we measured the density of landslides, landslide area, the ratio of landslide area, slope angle, and slope relief in the area divided with the distance from earthquake fault, positional relation between landslides and the earthquake fault and geological feature.

We select Iwate-Miyagi Inland earthquake as the research area. We divided the research area at intervals of 1km from the earthquake fault, positional relation between landslides and earthquake fault, and the difference of geological feature. Then we measured the area, slope relief and slope of landslides. At result the density of landslide area in the divided area where the distance from earthquake fault is 1˜10km, and that is on earthquake fault, is much more than other area.

Keywords: landslide induced by earthquake, Iwate-Miyagi Inland earthquake