Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

HDS29-01 Room:415 Time:April 28 11:00-11:15

Holocene rock avalanche phenomena from the upper Okumatashirodani Basin, Kamikochi Valley, northern Japanese Alps

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Hummocks and a minor ridge both of which have been considered to be moraines are present on alluvial fans near the Shinmurabashi Bridge, Tokusawa Area of Kamikochi Valley in the Hida Mountains. A series of geomorphological, lithological, and chronological studies of these landforms and their forming materials revealed that hummocks and a minor ridge were formed by two different rock avalanches that occurred on the steep east face of Kitahotaka-dake north ridge about 3000 m ASL and ran into valley floor near the Shinmurabashi Bridge. A terrestrial cosmogenic nuclide dating method of igneous rocks comprising hummocks and a minor ridge showed that hummocks were formed during 6.0-7.9 ^{10}Be ka and a ridge was during 0.8-1.1 ^{10}Be ka.

Keywords: landslide, in-situ terrestrial cosmogenic nuclide dating, Hida Mountains

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Rock failure of welded tuff in Sounkyo valley, Hokkaido, on September 2013

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A rock failure occurred at the left valley side of the Ishikari River in Sounkyo, Hokkaido, on 8th September 2013. Although Route 39 runs along the Ishikari River, rocks did not reach on the road, because the road is 170m distance from the collapse slope in the other side of the Ishikari River. However, the rock debris buried a part of the river, and formed a 200m-long flooding area at the upper reach. The type of this rock failure is a rock slide to a debris avalanche with high velocity flow.

Paleogene shale of the Hidaka Supergroup is overlain by Sounkyo welded tuff at the valley wall. Sounkyo welded tuff consists of two facies. The lower is a soft non-welded part, and the upper is a welded part with developed columnar or platy joints. Sounkyo valley has been formed by erosion of the pyroclastic flow deposits (30Ka), Sounkyo welded tuff, from Ohachidaira Caldera by the Ishikari River. In consequence, steep cliffs have developed in the valley. At the collapse point, only the uppermost 30m of the slope is steep cliff, but the lower 140m is about 40 degree. According to air photo interpretation, the surface with gently roughness profile develops on the 40 degree slope. This shows talus deposits as past collapse debris overlie the slope.

The area of the slope failure, erosional and depositional area, is 190m in height, 90-100m in width, and 365m in length. The equivalent coefficient of friction is 0.52. The volume of the collapse is more than 33,000m^3. Sounkyou welded tuff is exposed on the upper slope with 90m height, and the debris of the collapse covers on the lower slope with 95m height. A debris slump, 45m height and 20m width, is locates on the lower center part of the debris slope. A part of the past talus deposits is exposed by this debris slump. The Hidaka Supergroup shale is covered with talus deposits. Springs from the piping halls eroded the gullies in talus, and the talus deposits were wet state at the investigation of two days after the failure.

The debris from the collapse slope was spread in lobe-shapes over the valley flat. Arcuate ridges and troughs, 1-2m high, shaped concentric half circles in the center axes of the main lobe. This suggests flow-type mass movement. The debris is distributed on 130m in length and 120m in width of the valley flat. The most of the debris is grayish white welded tuff, and the pale reddish welded tuff originated from the uppermost slope is distributed around the ridges. Shale of the Hidaka super group is rare. The squeeze of the mixture of the soil deposits, composed of woods and organic matters, and volcanic ash is distributed in front of the ridges and in gaps in the troughs. This was dragged from the base of the moving body of the collapse, and played a role in a flow layer, matrix facies, of debris avalanche. The talus deposits would be fluidized. The debris would run with high velocity at the front part of the depositional area. According to the estimating equation (Sceidegger, 1973), using the equivalent coefficient of friction, the velocity is estimated by 38m/s at the foot of the slope.

The rock failure was occurred by the bellow mechanism. Rock slide was occurred near the boundary, the Hidaka Soupergroup shale and the non-welded part of the tuff, and the upper slope broke down. Ground water concentrates in the permeable layer of the non-welded tuff on the impermeable layer of the shale. Because the pyroclastic flow, the Sounkyo Welded Tuff, buried the former valley slope of the Hidaka Soupergroup shale in 30,000 years ago, the boundary is incline toward the river, and also the structure of the tuff is incline. This rock failure was occurred at the instability slope, which consisted of soft non-welded tuff with concentrated groundwater beneath heavy welded tuff. The columnar joints, the collapse surface, at the uppermost of the slope have opened before the rock failure, because moss grows on the joint surface.

Keywords: rock failure, welded tuff, rock slide, debris avalanche

HDS29-03 Room:415 Time:April 28 11:30-11:45

Geologic causes of Akatani rockslide induced by heavy rain with typhoon Talas (1112)

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Heavy rain by the Typhoon Talas in 2011 triggered many landslides at Kii Peninsula. The Akatani rockslide in Gojo City, Nara Prefecture is one of the largest landslides, which has dimensions of 500 m wide, 1100 m long, about 80-100 m deep, and 10 million cubic meters in volume. Geologic causes of the rockslide were investigated.

Geology of the Akatani rockslide is composed of mudstone and sandstone of the Miyama Complex of the Shimanto Belt. Not only bedding plane, but also fault planes and joint planes formed in various stages are weak planes related to the rockslide. The average attitude of the bedding planes tends to dip steeply northward while varying. However, there are low-angle dip slip faults nearly parallel or daylight to the slope surface. These are considered to be out-of-sequence thrusts, because they obliquely intersect bedding plane and some of them subdivided the Miyama Complex into several tectonic units. The rupture surface is not smooth curved but rough. This was the combined fragile planes including faults subparallel to the slope. It is similar to the other landslides in the Shimanto Belt that simple slide along bedding planes did not occur.

HDS29-04 Room:415 Time:April 28 11:45-12:00

Development history of sagging around Kanmuriyama Pass, Gifu-Fukui prefecture boundary

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Recently sagging landforms like double ridges and uphill-facing scarps attract attention as precursors of large-scale landslides. Many types of large- and small-scale saggings have been ubiquitously found in the Japanese mountainous regions by the analyses of detailed topographic maps made by LiDAR survey. Their development histories and processes, however, are unclear. We report the results of field and chronological researches on saggings in the Kanmuriyama Pass area, Gifu-Fukui prefecture boundary. Since the lithology and age of sediments accumulated in the linear depression between the double ridges east of the Kanmuriyama Pass were reported in the last meeting, those on the uphill-facing scarps west of the pass will be presented in the meeting this year.

Four rows of uphill-facing scarps parallel to the slope are recognized on the south side of the prefecture boundary ridge about 2 km west of the Kanmuriyama Pass. The sediments accumulated in the linear depressions were collected and analyzed by the hand-auger boring and pit survey. Lithological characteristics of these sediments are common and they are composed of, in descending order, 1) carbonaceous mud/leaf litter mixture, 2) dark gray mud, 3) light gray mud, and 4) orange-color conglomeratic mud. This lithology is also similar to that of the sediments between the double ridges east of the Kanmuriyama Pass. The sediments in the first, second and third depressions from the top include Kikai-Akahoya tephra (K-Ah) about 7.3 ka or have peaks of volcanic glass contents of this tephra. The horizons of the tephra, however, are recognized in the different lithologies; the sedimentary environment about 7.3 ka varied with the depression. The ages of the tephra and the AMS-^{14}C ages of wood fragments embedded in the sediments indicate that the sedimentation rates of the dark and light gray mud members are about 0.08 mm/year, and several times slower than those of the upper carbonaceous mud/leaf litter mixture member. The depressions and uphill-facing scarps formed about several tens of thousand years ago on the basis of the estimation of the thickness of sediments and the extrapolation of the sedimentation rate of the mud formations.

Keywords: sagging, landslide, Gifu, Fukui, Kanmuriyama

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HDS29-05 Room:415 Time:April 28 12:00-12:15

Detection of pre movements of landslide or deep collapse using InSAR and LiDAR

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It is possible to detect pre movements of landslide or deep collapse using SAR interferometry technology. As previous studies, there are example of the Shimegake Landslide on the foot of Mt. Gassan, Yamagata Prefecture and the Ohkamizawa Landslide in Higashi-naruse Village, Akita Prefecture. In this research, the usefulness of the monitoring methodology which combined SAR interferometry and LiDAR data will be verified for the monitoring of region where the deep collapse will occurred. This research is supported by the Grants-in-Aid for Scientific Research (No.22500994). The main verification fields are Nagano Prefecture and Shizuoka Prefecture. The used InSAR imageries are analyzed by Geodetic Department, the Geospatial Information Authority of Japan, using the data of PALSAR which is L band SAR of the earth observation satellite "Daichi" (ALOS).

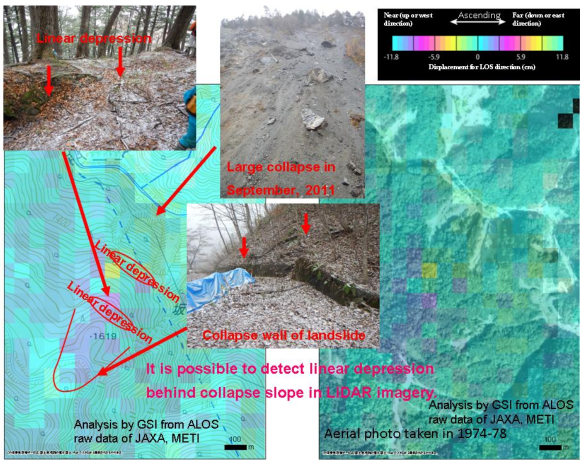
Near the Kuchisakamoto Landslide of Shizuoka Prefecture, a change significant by InSAR imagery in the autumn of 2008 and the autumn of 2009 had occurred, and about 6-7 cm deformation to the LOS direction was observed in one month and a half of 2009. In field survey, the authors checked that the large landslide had occurred between November, 2012 and June, 2013 (Nakano et al., 2013; Koarai et al., 2013).

In west side of Sakamaki hot spring of Nagano Prefecture, about 6-7 cm deformation to the LOS direction was observed in InSAR imagery of one year from 2008 to 2009, and large collapse occurred in September, 2011. In LiDAR data imagery taken before the collapse occurred, it is possible to detect linear depression behind collapse slope.

In this presentation, the authors report many case of pre movement of landslide detected by field survey or LiDAR data in the areas where InSAR imageries show small deformation in Nagano Prefecture.

Fig.1 InSAR imagery of west side of Sakamaki hot spring (2008/07/20-2009/09/07) and sloop deformation detected in field survey

Keywords: deep collapse, landslide, InSAR, LiDAR, Nagano Prefecture



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HDS29-06 Room:415 Time:April 28 12:15-12:30

Prediction and stability evaluation of potential sites of deep-seated catastrophic landslide

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Chigira (2009) and Chigira et al. (2013) analyzed geological structures and topographic features of deep-seated catastrophic landslides induced by rainstorms in accretion complexes of the southwest outer belt of Japan, and found that those landslides had been preceded by gravitational slope deformation typified by small scarps along their future crowns, which could be a clue to predict potential sites of catastrophic deep-seated landslide. This paper summarizes the methodology of potential site prediction and stability evaluation of catastrophic landslides, including stratified rocks in addition to broken beds and mixed rocks in accretion complexes.

In order to extract potential sites of catastrophic landslide, we need to judge whether deep-seated gravitational slope deformation may develop to catastrophic failure or not, considering possible structures of gravitational slope deformation on a certain geologic background. We examined the relationships among morphological expression of gravitational slope deformation, geologic body, geological structure, and deformation mechanisms, then took account of upslope and downslope conditions, and finally tried to evaluate the probability of catastrophic failure with the help of our experience of previous catastrophic landslides.

Irregularly shaped bumpy slope:

This is typically made when incipient sliding zones are being made in a rock body with complex discontinuities like broken beds or mixed rocks. Only this topography does not suggest the high probability of catastrophic failure, but additional eye-brow shaped small scarps and failures in the lower part of a slope may suggest high probability.

Linear depressions and wrinkles:

Symmetric alignment of linear depressions on both sides of a ridge suggests lateral spreading with the settlement of the ridge top, which does not likely develop to catastrophic failure.

Linear depressions and wrinkles developed on one side of a ridge are made flexural toppling of steeply dipping foliations of bedding or cleavage. This type is self-stabilizing deformation, but when downslope-facing eye-brow scarps are made and lower part of the slope is failed, catastrophic failure likely occur. Ridge-top depressions, when connected to steps and to a hollow on the side margin of a deformed area, catastrophic failure also likely occur.

Large head scarps or ridge top depressions:

These topographies on an under-dip cataclinal slope suggest buckling deformation, which may be stable when a competent rock layer exists or deformation extent is less, but when the deformation progresses further and lower slope is failed, the probability of catastrophic failure becomes high.

Large head scarps or ridge top depressions on an over-dip cataclinal slope suggest sliding in a strict sense with mature and continuous sliding zones. Such a landslide may continue slow movement without catastrophic failure, but when the foot is cut by failure, it may develop to catastrophic failure.

References

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Chigira, M., Tsou, C.-Y., Matsushi, Y., Hiraishi, N., Matsuzawa, M., 2013. Topographic precursors and geological structures of deep-seated catastrophic landslides caused by Typhoon Talas. Geomorphology, 201, 479-493.

Keywords: deep-seated catastrophic landslide, gravitational slope deformation, site prediction, susceptibility evaluation

Estimation of the slip-surface of landslide using electromagnetic approaches at Nishiikawa, Japan

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Landslide is one of the severe disasters triggered by rainfalls or earthquakes. Recently, landslides tend to increase by global-warming. Therefore, exploration into behavior of landslide becomes more important disaster prevention.

In order to explore landslide's behavior, we verified if there is slip-surface or not using magnetic approaches. In previous research, we had selected a test slope at Nishiikawa, Tokushima and we had performed electrical resistivity exploration and core-sampling. The core-sampling results indicate that there exists the structure which corresponds to slip surface. To verify this result, anisotropy in magnetic susceptibility (AMS) and natural residual magnetization (NRM) of samples that include that structure and periphery of it were measured. AMS result showed that slip-surface region provides the oblate ellipsoid characteristics, which was consistent with the developmental mechanism of slip-surface during sliding. And result of NRM indicated that magnetic minerals in slip-surface region oriented certain direction. This describes that magnetic minerals was able to move in saturated region and then were oriented to direction of earth magnetism.

These studies showed the possibility to identify slip-surface using rock magnetic approach. However, we found necessity of consideration of core-sampling technique to estimate the direction of slip using this approach because samples had rotated during core-sampling.

The details will be provided in the presentation.

Keywords: landslide, anisotropy in magnetic susceptibility, natural residual magnetization