

## Accumulation patterns of in-channel modern deposits in the lower Stung Sen River

NAGUMO, Naoko<sup>1\*</sup> ; SUGAI, Toshihiko<sup>2</sup> ; KUBO, Sumiko<sup>3</sup> ; OKAZUMI, Toshio<sup>1</sup>

<sup>1</sup>ICHARM, PWRI, <sup>2</sup>Graduate School of Frontier Sciences, University of Tokyo, <sup>3</sup>School of Education, Waseda University

The Stung Sen River flows down the central region of Cambodia, is the main tributary in the Tonle Sap drainage basin. It develops fluvial lowland in its downstream and the longitudinal profile is very flat, with the slope of less than 0.1 ‰. Monsoonal precipitation provides seasonal flood every year in the fluvial lowland and cyclic water level changes of the Tonle Sap Lake about 8 m in the river mouth, therefore the river seems to change sediment transportation processes in each season. While meander scrolls formed by channel migration and back marsh are found in the floodplain throughout the year (Nagumo et al., 2013), four types of channel bars are recognized within the river channel about 10 m lower than back marsh during dry season. Outcrop observations at concave type channel bars revealed the alternate layers of reverse-graded sand and mud layers, and inserted plastic pieces with date stamps indicated that the deposits are quite new and have been partly replaced to reflect flow regime changes of the river. Such sedimentary structures suggest that minute fluctuations of water level and discharge control bar construction, and would be important source to understand recent flood history and patterns.

Keywords: fluvial lowland, meander, monsoon, water level fluctuation, Lake Tonle Sap, Cambodia

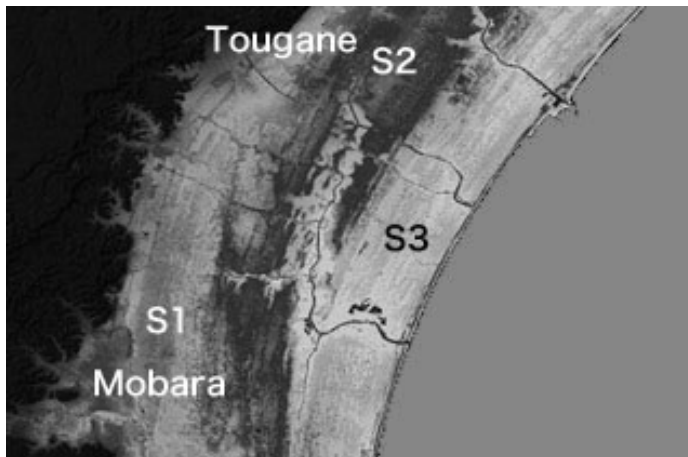
## Development of Strandplain Ridges Group in the Kujukuri Coastal Plain by LiDAR DEMs

OOI, Shinzou<sup>1\*</sup> ; NANAYAMA, Futoshi<sup>2</sup> ; NAKASHIMA, Rei<sup>2</sup>

<sup>1</sup>GSI/AIST, <sup>2</sup>AIST

The DEM data based on an Airborne laser survey was fixed recently, and it became possible also in the Kujukuri Coastal plain to use this DEM data. Then, this DEM data analyzed the microtopography of the plain. And the development of the Kujukuri Coastal plain, especially the north-south difference were considered.

Keywords: Kujukuri Coastal Plain, Strandplain ridge, LiDAR DEMs



## Controlling factor on evolution of late Pleistocene to Holocene sequences in Nara Basin

HORI, Kazuaki<sup>1\*</sup> ; ITO, Nobuaki<sup>1</sup> ; TAKADA, Masashi<sup>2</sup>

<sup>1</sup>Department of Geography, Graduate School of Environmental Studies, Nagoya University, <sup>2</sup>Department of History, Sociology and Geography, Faculty of Letters, Nara Women's University

Many researches on late Pleistocene to Holocene sequences (Chuseki-so) have been carried out in coastal lowlands. In contrast, stratigraphy and evolution of alluvial plain located above the coastal lowlands is less well known. We focus on Nara Basin to clarify stratigraphy and evolution of alluvial plain.

Two borehole cores (MK1, MK2) were taken at Matsukasa, Yamatokoriyama city located in the middle part of the basin. Sedimentary facies analysis and AMS radiocarbon dating were performed. Stratigraphy of late Pleistocene and Holocene deposits was built by analyzing existing borehole columns and radiocarbon ages. Additionally, an incised valley formed beneath the Kawachi Plain located near the Old Yamato river mouth during the sea-level lowstand was reconstructed by analyzing existing borehole logs. Sediment accumulation rate of the basin mainly during the last two millennia was estimated from depth of remains shown in archaeological reports published by Archaeological Institute of Kashihara, Nara prefecture.

Radiocarbon ages obtained from the cores suggest that thickness of Holocene deposits is less than approximately 3 m and they have mainly accumulated after 2,000 cal BP. The timing is not related to sea-level change of Osaka Bay. Sea-level change would affect change of river-bed gradient at Kawachi Plain near the river mouth. However, Kamenose narrow segment in Ikoma Mountain is located between Kawachi Plain and Nara Basin and is composed of Cretaceous and Neogene igneous rock. Rock hardness may have resulted in small incision rate of the river bed at the segment, and influence of the sea-level change above the segment was little.

Geological section of Nara Basin shows thickness of Holocene deposits on south area is larger than that of north area. Discharge and drainage area of south district are ca. 2.3 times larger than those of north district. This may be related to the difference in thickness of Holocene deposits.

Depth of remains during the era of Yayoi to Kamakura suggests that increase in sedimentation rate occurred after Asuka era. Existing pollen analysis results indicate that second growth forest probably influenced by human activity had already occurred in and around the basin at Kofun era. Therefore, it is possible that artificial effects in the basin caused increase in sediment production and influenced formation of late Pleistocene to Holocene sequences in Nara Basin.

Keywords: Late Pleistocene to Holocene sequences, inland basin, borehole log, Nara Basin

## Quantitative Evaluation of Microtopography in the Riverside Land of the Mizunashigawa River, Japan

OGURA, Takuro<sup>1\*</sup> ; AOKI, Tatsuto<sup>2</sup>

<sup>1</sup>School of Humanities, Kanazawa University., <sup>2</sup>School of Regional Development Studies, Kanazawa University.

This research did the quantitative assessment of how the amount of encroachment changed and microtopography change in the outside area of the new dike, which modify the land, of Mizunashi River. The origin of this river is the mount Unzen which is well known of its eruption in 1990. This area is unique because of the artificial preparation of the soil; its base-level of erosion was reset. Thus, this area cannot be discussed by the usual landform evolution, but quantitative assessment.

The result of the research showed that the effect of the change can be divided into 4 periods. There was no large-scale debris flows and erosion of the lateral had progressed with the formation of the micro watercourse network in the 7 years since the 1998. debris flows in the riverside land stabilized as the result of the terrain became stable in 2005.

There were debris flows that occurred intensively in a short period while 2005 to 2008. They were large enough to cause the outflow of the vegetation of the surface layer. As a result of these debris flows, the lateral erosion changed to the downward erosion. After those debris flows, the passage was fixed.

There was a rapid recover of the flora in 2011. This increased the stability of the outside area of the bank.

### Overview of the area

It has been more than 20 years since the Heisei eruption; however, a light rain amount of about 20 ~30mm rainfall time can cause debris flows in the Mizunashi River. To minimize the damage of the volcanic disaster, constructions for the erosion control are still continuing.

### Results and the research method

#### Calculation of bare land ratio by GIS

Putting the base-level of the erosion to the 1998, as the time lapses the ratio of the bare land decrease. For instance the bare land area was 91.62[%] in 2003, but in 2005 it became 50.32[%]. However, the ratio of the 2008 was 58.66[%] and after 2008 the ratio is repeating a micro increase and decrease.

#### Calculation of the flow path extending ratio

The calculation is about the the ratio of the flow path extending of the same waterway since 2008. The result of the calculation shows the quantitative assessment of the immobilization of the channel. This is shown by the result of the 2008, 2011 and 2013, in these three years the ratios are 1.11 and 1.10.

#### Measure of the erosional cross section and local observation

The survey date show the width of gully is 8.27[m]. This is approximately equal to the size of the width and gully erosion in the upper reaches. This date can be seen in the report of 2011 by the Unzen reconstruction office. Calculating the average erosion speed ( $v$ ) from the base level of erosion and the maximum deepening speed ( $Mv$ ) from the maximum depth of erosion, the results are  $v=4.66$ [cm/year] and  $Mv=20.6$ [cm/year]. These results show two things. First, the lateral erosion has the bigger scale than that of lower erosion. Second, the direction of the erosion changed recently from horizontal to down.

Keywords: geomorphological process, gully erosion, debris flow, GIS, Unzen Volcano

## Timing of sediment discharge events on a welded tuff slope in Chugoku Mountains, Japan

WAKATSUKI, Tsuyoshi<sup>1\*</sup> ; YAMADA, Ryuji<sup>1</sup>

<sup>1</sup>National Research Institute for Earth Science and Disaster Prevention

Many slope disasters were occurred by a heavy rain on July 28, 2013 in Yamaguchi and Shimane Prefectures. In particular, a number of shallow slope failures and debris flows occurred on mountain slopes underlain by rhyolite-dacite welded tuff in the Tsuwano Town, Shimane Prefecture and the adjacent Ato District, Yamaguchi City. The debris flows eroded the sidewalls and the riverbed of the flow channel, and outcrops of deposits accumulated by sediment discharge events older than 2013 appeared intermittently. From five outcrops along two channels, we collected 11 chip samples of the woods that may have buried and died at the time of the sedimentation. We performed <sup>14</sup>C dating of them, and the calendar-calibrated radiocarbon ages showed a 0.6 - 52 Ka BP. Sedimentary structures suggest that these ages correspond to the occurrence time of debris flows and slope failures in the past.

Keywords: <sup>14</sup>C dating, debris flow, slope failure, soil slip

## The characteristic of roots distribution on the slopes in Izu-Oshima where landslides were occurred by Typhoon No.26

MURAKAMI, Wataru<sup>1\*</sup> ; OGAWA, Akiho<sup>1</sup> ; OGAWA, Yasuhiro<sup>1</sup> ; DAIMRU, Hiromu<sup>1</sup>

<sup>1</sup>FFPRI

Large-scale landslides were occurred in Izu-Oshima by Typhoon No.26 on October 16, 2013. By the urgent investigation after the disaster, it is reported that the landslides were occurred in the part within about 1m from the slope surface and the few rhizomes were on the slip surface. We surveyed the distribution of the fallen trees (species, height, the root depth, and the extensions (widths) of the roots) on the slope near the landslide. The surveyed fallen trees were a lot of *Eurya japonica*, and were the order of *Ilex crenata var.hachijoensis*, *Prunus lannesiana var. speciosa*, and *Camellia japonica*. Most of the surveyed fallen trees were about 5-7m in height, and the high one was 10m or less. The root depth of most fallen trees was 60-80cm; however, the root depth had the difference by the tree species. The *Camellia japonica* and the *Prunus lannesiana var. speciosa* had comparatively deep roots. On the other hand, the *Eurya japonica* and the *Ilex crenata var.hachijoensis* tended to be distributed shallowly the root systems. As a factor to which the root systems are not deeply distributed, a peculiar properties of soil situation of the volcano is pointed out. In this survey, the difference of characteristics of the tree species on the surveyed slopes was guessed as a cause, too.

Keywords: Izu-Oshima, Typhoon No.26, landslide, roots distribution

## Verification of incision rate estimation based on the geomorphological history of river terraces in Kaligandaki, Nepal

YOSHIDA, Takahiro<sup>1\*</sup> ; SUGANUMA, Yusuke<sup>2</sup> ; MAEMOKU, Hideaki<sup>3</sup>

<sup>1</sup>The Graduate University for Advanced Studies, <sup>2</sup>National Institute of polar research, <sup>3</sup>Housei university

The Himalaya is the highest mountains of the world. To estimate long-term (1 ~100 kyers) uplift history of the Himalaya, erosion rates of the incised river have been used with presuppose of dynamic equilibrium between tectonics and aggradations. This estimation is based on the correlations of the river terraces, however, depositional processes of the terraces usually have not been described in detail.

The Kaligandaki is the one of the longest river across the Nepal Himalaya. The long-term uplift history of the Himaraya has been estimated from the distribution of Holocene and Pleistocene terraces along the Kaligandaki river. In this study, we carried out the detailed geomorphological and sedimentological survey at the upper and middle part of the Kaligandaki River to verify the correlations of the river terraces. The fluvial terraces at the upper part of the Kaligandaki river is thought to be originated to the local sediment supply from three phases of the glacial events, although the middle part of the terraces are fluvial sediment. This indicates that correlations of the river terraces along the Kaligandaki river is not suitable for the estimations of incision rate and uplift history of the Himalaya.

Keywords: Himaraya, Geomorphology, Kaligandaki, Fuluvial terrace

## Field measurements on the reduction of wave height on a fringing reef: A study from the Miibaru coast, Okinawa Island

TAKEISHI, Yu<sup>1\*</sup> ; AOKI, Hisashi<sup>2</sup> ; MAEKADO, Akira<sup>3</sup> ; HIROSE, Takashi<sup>3</sup>

<sup>1</sup>Graduate School of Humanities and Social Sciences, University of the Ryukyus, <sup>2</sup>Faculty of Business Administration, Daito Bunka University, <sup>3</sup>Faculty of Law and Letters, University of the Ryukyus

To investigate the relationship between reduction of wave height on a fringing reef and the water depth at the reef edge, field measurements were carried out on Miibaru coast with a fringing reef in Okinawa Island, Japan. The ratio of the shore break height (the height of final breaking waves near the shoreline) to the wave height at the reef edge,  $H_b/H'$ , which denotes the degree of the reduction of wave height on a reef, was found to decrease with decreasing water depth at the reef edge. This result indicates that the reduction of wave height on a reef is greatly controlled by water depth on a fringing reef.

Keywords: Reduction of wave height, Coral reef, Fringing reef, Water depth, Okinawa Island



## Experiments on Salt Weathering in Cold Environments : Effects of Dissolved Salts on Frost Shattering

SATO, Masato<sup>1\*</sup> ; HATTANJI, Tsuyoshi<sup>2</sup>

<sup>1</sup>Graduate School of Life and Environmental Sciences, University of Tsukuba, <sup>2</sup>Faculty of Life and Environmental Sciences, University of Tsukuba

Weathering experiment was carried out to investigate the effects of dissolved salts on frost shattering using four types of rocks (two tuffs, one sandstone and one andesite) and three types of salt solutions (sodium chloride, sodium sulphate and magnesium sulphate). Cubic specimens with a side of 5 cm in length were immersed in saturated salt solution of NaCl, Na<sub>2</sub>SO<sub>4</sub>, MgSO<sub>4</sub> or distilled water for 72h. After immersion, the specimens were covered with foil and subjected to up to 80 freeze-thaw cycles in a cold chamber where the temperature ranges from -30 °C to 10 °C within twenty four hours.

Freezing points of salt solutions were decreased by dissolved salts. In particular, the saturated solution of NaCl did not freeze under -25 °C. The liner strain on the surface of specimens was measured with strain gauge during freeze-thaw cycle. The specimens immersed in salt solutions showed greater freezing strain than those immersed in distilled water. Specimens with MgSO<sub>4</sub> solution produced the large strain. In most cases, the strain strongly correlated with Weathering Susceptibility Index (WSI). The decreasing rates of the longitudinal wave velocity and the Equotip hardness value during freeze-thaw cycles also correlated with WSI.

Keywords: salt weathering, frost shattering, cold environments, freezing strain, laboratory experiment

## The volume expansion of pyroclastic rocks by the crystal growth of Halloysite at the Higashidoori

NAKATA, Eiji<sup>1\*</sup> ; OUYAMA, Takahiro<sup>1</sup> ; TORIGOE, Yuji<sup>2</sup> ; MIWA, Tadashi<sup>2</sup> ; CHIGIRA, Masahiro<sup>3</sup>

<sup>1</sup>Central Research Institute of Electric Power Industry, <sup>2</sup>Tohoku Electric Power Co., Inc., <sup>3</sup>Disaster Prevention Research Institute Kyoto University

We find the ground deformation by volume expansion of pyroclastic rocks at the Higashidoori Nuclear power station site. The Tomari formation is strongly altered by light brown colored weathering with halloysite crystallization. The Tomari formation mainly consists of lapilli tuff including andesitic lava. The Gamanosawa formation is laid on the Tomari formation consists of alternated sandstone, mudstone, conglomerate and tuff layers. These stratum are covered by the middle terraces deposit including the Toya tephra: 110 ka and Towada red tephra: 80 ka. Towada red tephra in the middle terrace deposit is not deformed on this site.

The convex deformation is formed absorbing the water of montmollironite in fault zone (clay rich zone). Strongly weathered surface rocks of the Tomari and Gamanosawa formation are also deformed toward upper parts around fault zone. This deformation is also formed regardless of fault zone.

Montmollironite distributes at the deeper area (the Tomari formation) which consists of weakly weathered rocks. Halloysite crystallized from montmollironite at shallow area. Plagioclase disappears with the crystallization of halloysite by XRD results. Halloysite which formed tube shapes covered the all over the materials are changed the shape to aggregation of fan shapes by SEM observation. Halloysite crystals increases a distance of the space between minerals under the micro scopic observation.

To assume that Ti is immobile elements with weathering in the rock, the volume of weathered rocks (lapilli tuff: the Tomari formation) increases in 1.3 to 1.5 times to compare with fresh rocks.

Montmollironite crystallizes the surface of minerals at first. After crystallization of montmollironite, halloysite crystallizes on the montmollironite to be affected by weathering at shallow depth.

Crystal growth of halloysite causes the volume expansion of rock and the deformation of ground surface. The old faults plane and joints slip as the appearance reverse faults by crystal growth at this site.

Keywords: Halloysite, Volume expansion, Higashidoori