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

HQR23-01 Room:414 Time:May 1 09:00-09:15

Characteristics and Development Processes of Wetlands on Landslide Masses in Hachimantai Volcanic Group, NE Japan

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Wetlands are widely distributed in the mountainous regions in Japan, and are subject to protection and conservation because of their beautiful landscapes and their peculiar biota. Considering not only their climate and hydrological conditions but also their geomorphological conditions is necessary to characterize development processes and environmental responses of wetlands. In tectonically active and warm humid regions like Japan, landslides are one of the most important factors for mountain development. Recently the role of landslides creating biodiversity and landscape diversity has been much attracted attention in the field of ecology and geomorphology(Geertsema *et al*., 2007). This study focuses on wetlands as one of the representative landform units composing landslides and presents their characteristics and development processes in Hachimantai volcanic groups which have been deformed by many landslides. 'Wetlands' generally includes various types of water-rich conditions. In this study, as their primary components we focuses on 'bogs' and 'ponds', and define 'bogs' as grasslands in moisture conditions.

Hachimantai volcanic group stands in Ohu backbone range and is composed of some Quaternary complex basaltic or andesitic stratovolcanoes. Their bodies are being collapsed by landslides characterized by a variety of body size and structures: some have deformed into several numbers of sliding blocks. Wetlands occur in almost all large scale landslide bodies. Its climate is categorized in Japan Sea side climate pattern as heavy-snow.

We investigated the characteristics of wetlands using remote sensing images and digital elevation models and analyzed the relationship with landforms by GIS. Then we reconstructed the development process of typical wetlands located both in and out of the landslide masses by the analyses of the sediment including ^{14}C dating, tephra identification, carbon content measuring and grain size analysis.

On landslide masses 33.2 % (185 of the 599 in total) wetlands stood and area rate was 63.7 %. Most wetlands out of landslides stood on the volcanic original surface along the ridge line of Ohu mountain range or some were in the craters of Hachimantai volcano. The formers are the small bogs formed by meteoric-water (snow) cultivation in the nivation hollows. On the other hand, those on the landslide masses scattered widely. Large landslide masses frequently had ponds cultivated by ground water in the large and deep depressions along the scarps and in the small ones among pressure ridges.

In Oyachi, a wetland in a landslide, black mud and organic sand and silt (representing for bog and forest), sand and gravel (disturbance), clay and silt (pond) and peat (bog) deposited from their bottoms. Wetlands typically develop under the stable circumstance from ponds to bogs, and finally to forests. In the case of Oyachi, at BC 4000-3500 the bog changed to the pond, the former developmental stage, probably because the landslide activity formed the dam, and then it developed to the bog with stabilization of the slopes and the water discharge. On the other hand, the development process of Okuno-maki, a wetland out of landslides, were probably directly affected by climate changes. Diminishing erosion along with decreasing snow accumulation in the nivation hollow and warming of melt season climate toward the Medieval Warm Period enabled to be the bog. In contrast, landslide activities and denudation of landslide masses control the developmental stages of wetlands. Consequently, various ages and types of wetlands are presumed to coexist in humid mountains with large landslide masses.

Reference

Geertsema *et al*. (2007): Influence of landslides on biophysical diversity -A perspective from British Columbia. *Geomorphology* 89, 55-69.

Keywords: wetland, landslide, development process, Hachimantai

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HQR23-02 Room:414 Time:May 1 09:15-09:30

Comparison between two chronological methods - in situ TCN and WRT applied to periglacial landforms in Kiso Mountains

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A lot of types of chronological methods have been suggested in the field of earth science. Chronological methods are classified into absolute dating methods and relative dating methods. Absolute dating methods contain isotopic age or tree-ring chronology for example, and they provide the age as numerical values. Otherwise, relative dating methods are the methods which detect the time series of the formation of geomorphology or deposition. However, they cannot fix the age without the absolute age data (Watanabe, 1990).

Two chronological methods - in situ Terrestrial Cosmogenic Nuclides (TCN) and weathering-rind thickness (WRT) -are subjected. These two methods are especially effective in high mountain areas as it is difficult to find radiocarbon samples or key tephra layers (Aoki, 1994). These two methods were compared using terminal moraines in the cirques (Aoki, 2000). However, this comparison is not made in other mountainous terrains, and it is made in Kiso Mountain Range in this study.

In order to compare these two methods, samples were taken from multiple ridges in the eastern part of Mt Kisokomagatake, and Shirabidaira. Six samples were taken from 3 ridges and 2 depressions of triple ridges, and one sample from Shirabidaira. In order to obtain the exact formation age, we selected the bedrock or the oldest boulder filling the depression and collected their surface layer of 4 cm or less in thickness

Each sample is divided in two, one for TCN and the other for WRT.

10Be exposure dating method is subjected as TCN. The samples are chemically preprocessed and at MALT (Micro Analysis Laboratory, Tandem Accelerator), University of Tokyo. The exposure age is calculated by means of the formula as follows(*)

$T=-1/\lambda \ln\{(1-\lambda N/P)\}$ (*)

T: Exposure Age [yr] λ:Decay constant [1/yr] N: Number of isotopes [atoms/g] P: Production rate of isotopes [atoms/(g • yr)]

Weathering-rind is a discolored part of rocks. It is formed due to oxidation or hydration. Though the age is nearly in portion to WRT, its correlation depends on the rock type, sampling point and so on. In this study, samples were cut so that the weathering-rind can be observed as clearly as possible.

In 7 samples, radioactive ages are in either late Pleistocene or Holocene. Weathering-rind was observed and detected for 5 samples. There is a positive correlation between WRT and the exposure age. The primary regression equation is as follows : WRT [mm] = 0.367 $\times$ (Exposure age [kyr]) + 1.16. The correlation coefficient is about 0.85. This suggests that in order to get the exposure age of multiple ridges, WRT is also an effective method to a certain extent. Therefore, mean weathering rate (= 0.367 mm/kyr) can be gained by calculating a primary regression line that shows the relationship of the WRT and the exposure age. This weathering rate is the same in the order of magnitude as that (= 0.283 mm/kyr) estimated from Seki and Koizumi (1992).

Keywords: In-situ Terrestrial Cosmic Nuclides, Weathering-rind Thickness, Periglacial landforms, Kiso Mountain Range

Japan Geoscience Union Meeting 2014
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HQR23-03 Room:414 Time:May 1 09:30-09:45

Tree-line change since the Last Glacial from the pollen profile at the Hiroppara peat bog, central Japan

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To better understand the interaction between the human and environment in past period, this study reconstructed vegetation history and climate change since the late Pleistocene at the Hirropara peat bog (1,400m a.s.l.), central Japan, from the pollen and micro-charcoal profiles at HB-1A cores. Arboreal pollen assemblages and influx of the cores indicated the vegetation history and climate change since the Last Glacial Maximum as follows; 1) ca. 30,000˜19,000 cal BP, grassland and wasteland distributed due to decreasing the tree-line; 2) ca. 19,000 cal BP, around the site was covered with a mixed forest of boreal conifers and cool-temperate deciduous, because the tree-line passed the altitude of site; 3) ca. 16,000 cal BP, Betula forest expanded; 4) ca. 12,000 cal BP, a cool temperate deciduous broad-leaved forest consisting of *Quercus* subgen. *Lepidobalanus* and *Carpinus* was distributed; 5) ca. 4,000 cal BP, temperate conifer such as Taxaceae-Cupressaseae, Tsuga, and Abies increased; 6) secondary forest of *Pinus densiflora* and *Larix kaempferi* plantation increased in ca. 500 and 100 cal BP, respectively. It is highly possible that the tree-line change impacted strongly the human activities since the Last Glacial Maximum.

Keywords: pollen analysis, vegetation history, tree-line, obsidian, prehistoric age, central Japan

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HQR23-04 Room:414 Time:May 1 09:45-10:00

Vertical crustal movements along the Japanese coastlines inferred from the Quaternary and recent sea-level changes

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Observed relative sea-level (RSL) changes during the past 130 kyr are mainly caused by change of ocean volume, tectonic crustal movement and glacio-hydro isostatic adjustment (GIA) of the Earth in response to the redistribution of ice and water loads. Here we examine the tectonic crustal movements along the Japanese coastlines on three typical timescales (50 yr, 6 kyr and 125 kyr) based on several sea-level observations and their predictions due to GIA process and recent melting of mountain glaciers and both polar ice sheets. We use the observations of RSL based on tide gauge and Holocene RSL observations and the altitudes of marine terraces formed at the last interglacial (LIG) phase at about 125 kyr. The rates on a timescale of 50 yr are derived from tide gauge data, thermosteric sea-level changes due to thermal expansion of the oceans and predictions due to the GIA for the last deglaciation and also recent melting of the mountain glaciers and both polar ice sheets. Those for 6 kyr and 125 kyr are based on the RSL observations and the predictions by GIA modeling, considering uncertainties for temporal changes in eustatic sea-level for the mid- to late-Holocene and LIG phase. The inferred rates for 50 yr are significantly different from those for 125 kyr in most sites, particularly for sites along the coastline from eastern Hokkaido to northeastern Japan, Shikoku and south Kyushu facing the Pacific Ocean. In these regions, the rates for 125 kyr and 50 yr are positive (uplift) and negative (subsidence), respectively. Also, the observed RSL changes at 6 kyr BP are consistent with the inferred RSL changes using the rates for 125 kyr and GIA-predictions in many sites, but inconsistent with those for 50 yr in most sites except for a few sites. These results suggest that the rates on a timescale of 50 yr are not representative of the tectonic crustal movements for timescales longer than 6 kyr in most sites along the Japanese coastlines. The inferred rates on these timescales may be useful in discussing the recurrence of megathrust earthquake with its interval of about 1 kyr like the 2011 off the Pacific coast of Tohoku Earthquake.

Keywords: crustal deformation, sea-level change, Quaternary, tide gauge, thermometric sea-level

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HQR23-05 Room:414 Time:May 1 10:00-10:15

Prehistoric human activity around the Hiroppara wetland, central Japan: a case study in and around the obsidian sources

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The Hiroppara wetland is located about 1.5 km to the north of Wada-toge, a well known obsidian source 1,400 m above sea level. Many prehistoric sites and geological obsidian sources are scattered around this area.

Through general surveys and small-scale excavations conducted by the former Wada Board of Education between 1989 and 1991, several prehistoric sites were identified around the wetland. In 2011, the Center for Obsidian and Lithic Studies (COLS), Meiji University began a new research project on this wetland and the prehistoric sites around it. Our research goal is to reveal the relationship between human activities in and around the obsidian sources and paleoenvironmental changes during the late Late Pleistocene (Upper Palaeolithic) to the Early Holocene (Incipient to Early Jomon period). This presentation is a preliminary report of our research, with a particular focus on the results of our archaeological excavations.

On the basis of results of previous surveys and our observations of the topographical features around the wetland, we distinguished the archaeological landscape around the wetland into seven sites, which we numbered from I to VII. The COLS has set up an excavation area 1 (EA-1) at site I and excavation area 2 (EA-2) at site II.

Excavations at EA-1, the Hiroppara I site, and EA-2, the Hiroppara II site, have revealed the following:

1. EA-1

1) This site yields evidence of an Early Upper Palaeolithic lithic industry from layer 6 (under the Aira-Tn tephra).

2) The latter part of the Late Upper Palaeolithic industry, represented in layers 2b and 3, primarily features bifacial points with a blade core.

3) Incipient to Early Jomon period assemblages are found in layers 2a and 2b.

2. EA-2

1) The early part of the Early Upper Palaeolithic industry, from layers 4a and 4b, yields an "obsidian concentration" characterized by a dense lithic concentration in a small area mainly composed of large lithics. Layers 4a and 4b contain the Aira-Tn tephra and a ground-edge stone ax made from tremolite rock.

2) The latter part of the Late Upper Palaeolithic industry, from layer 3, appears to be a knife-shaped tool industry using a developed blade technique.

3) Jomon pottery of the early part of the Initial Jomon with pebble concentrations and a pit, arrowheads, and cobble tools.

These new findings expand the scope of information about multilayered prehistoric occupations at the Hiroppara I and II sites. In addition, it has allowed us to extract a significant amount of information on prehistoric human behavior with specific regard to exploitation, transportation and consumption of obsidian during the late Late Pleistocene to the Early Holocene. However, these issues require further study.

Keywords: Obsidian sources, Central Japan, Hiroppara wetland, Hiroppara site group, Jomon period, Upper Palaeolithic

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HQR23-06 Room:414 Time:May 1 10:15-10:30

Prehistoric obsidian exploitation in the Central Highlands obsidian sources and excavations of the Hiroppara site group

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The Center for Obsidian and Lithic Studies, Meiji University (COLS) has conducted archaeological and palaeoenvironmental excavations at the Hiroppara wetland and prehistoric site group (sites I and II) located 1,400m of the Kirigamine mountains in Nagawa Town, Nagano Prefecture, Japan. This paper presents a review of the Central Highlands obsidian source area where Hiroppara is located and its circumstances of prehistory, and preliminary results of Hiroppara excavations. Many sites assigned to the Upper Palaeolithic and the Jomon periods have been discovered in and around the Central Highlands. The site distribution of both periods shows distinctive patterns. The Upper Palaeolithic sites concentrate in relatively high-altitudinal zone over 1,000m close to the obsidian sources, while the Jomon sites shows dense-distribution on the hill slopes in low-altitudinal zone below 1,000m. This ebb and flow pattern reflects historical changes between the Upper Palaeolithic and the Jomon periods in the technology of obsidian acquisition, the way of land-use in the source area, the group organization, and the obsidian circulation system. The emergence of an obsidian mining site in the initial Jomon is one of representatives of those changes in the relationship between humans and obsidian. Data for archaeological chronology and changes in palaeoenvironment in the Central Highlands, however, are less accumulated than other areas, resulting in insufficient explanation for changes in human activities in and around obsidian sources. Multidisciplinary research on the Hiroppara wetland and site group provide us with a useful set of data concerning archaeological and palaeoenvironmental changes that represents a limited narrow area. The excavations of Hiroppara by COLS have been conducted three times in 2011, 2012, and 2013. The excavations at sites I and II have unearthed several cultural layers ranging from the Early and Late Upper Palaeolithic to the earliest Jomon. Palaeoenvironmental data during the late MIS 3 and the early Holocene have been obtained from microfossil analyses on the peat cores from the Hiroppara wetland. Though further analyses and integration on obtained data are still required, the Hiroppra wetland and site group will allow us to make an explanatory model for relationships between prehistoric humans and palaeoenvironmemt in and around obsidian sources of the Central Highlands.

Keywords: the Upper Palaeolithic, the Jomon, the Central Highlands, obsidian sources, the Hiroppara wetland, microfossil analysis

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HQR23-07 Room:414 Time:May 1 10:30-10:45

Discovery of fresh water diatom from aeolian sediments in the conical pit structure in the Arsanjan area, south Iran

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It is well known that the life of ancient people was greatly influenced by various natural conditions, such as climate, topography, and geology. In particular, geology is not only important as a source of raw material for stone tools and residence construction material, but also as a provider of groundwater and mineral resources. Furthermore, soil is generated from weathered bedrocks, and soil is a key influence on vegetation. Thus, when ancient people considered the natural conditions for first settlement locations, geology would have been a crucial factor in these conditions. The present paper offers a preliminary examination of interaction of the humankind - Iranian Zagros Mountains.

One of the most important discoveries among the humankind studies was the existence of many Middle Paleolithic and Epi-Paleolithic cave sites in the Arsanjan area, south Iran. One of the caves, named A5-3 (Qar-e Tang Sikan), produced a large amount of Middle to Epi-Paleolithic stone implements. Thus the Arsanjan area is one of the most suitable areas for the study of human evolution and cultural transition from the Middle/Late Paleolithic to the Epi-Paleolithic/Neolithic periods. This means that the investigation of this area can possibly provide opportunity for the better understanding of the evolution of modern Homo sapiens and of the interface of geology-archaeology.

We accomplished the trench survey recently. The results of B3 trench survey (4 X 4 m square) at A5-3 (Qar-e Tang Sikan) are as follows (Hisada and Tsuneki, 2013). The culture layers are divided into ten layers. Layers 1 to 3 correspond with Late Paleolithic to Proto Neolithic. Six samples from layers 2 and 3 indicate approximate 36,000 BP. Layers 4 to 10 are included into Middle Paleolithic culture layers. It is noteworthy that structure 3 was discovered from layer 7. Structure 3 presents a circular from on plan, 1 m in long axis and 0.7 m in short axis. In profile, it is conical and depth is about 50 m. Cave limestone bedrock is used as a bottom wall of the conical shape, and concrete-like harden wall with pebbles and clays is used as the other one. The concrete-like wall might be built after cutting soil surface. The filling of the conical shape structure is light orange color clay, 50 cm in thickness. This clay presents a bimodal pattern, 5 phi and 11 phi in grain size analysis, and consists of quarts, muscovite and hydroxylapatite. The color of the clay is characteristics (10YR7/6, 6/6 etc) and conspicuous from other soil. Based on the color and clay-seized sediments, it can be concluded that they are aeolian sediments. This conical structure may be intended to be a water-reserved place keeping water oozed from the limestone wall (Hisada and Tsuneki, 2013). Thus, the clay might be deposited in this conical pit, 50 cm deep. This laying down at the pit seems to be prevented from erosion and transportation because the pit was full of water. Very recently, it is clarified that clay bed yields diatom, Pinnularia spp.. This genus indicates a living in fresh water (Watanabe et al., 2005). The ages for layer 7 are inferred before 51,000 BP, because layer 5 is dated as 50 ± 2Ka and the ages for the boundary between layers 6 and 7 are 51 ± 2Ka based on the photoluminescence measurement (Ito, in pers. comm.).

Keywords: West Asia, Paleolithic ages, Iran, water-reserved place

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Quantitative detection of event deposits in the piston core of Beppu Bay, central Kyushu, Japan

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Particle transportation and deposition is repeated by various phenomena to be caused by constant cycle of water and atmosphere (non-event) and sudden phenomenon (event) such as earthquake, volcanic eruption, flood, and a stratum is formed. Therefore we can know paleo-disaster or climate change from the stratum. In addition, because the deposit caused by event (event deposits; Shiki, 1998) supplied a lot at a time, it is very important for solving formation process of the stratum. In recent years, due to analysis technique development high resolution/precision study in sedimentology is increasing (Katsuta *et al*., 2007). For this reason, details of the sedimentation mechanism and the environmental change are more clearly, but on the other hand influence of development on age models and various analyses is actualized. Therefore clear distinction of event and non-event is one of the important problems.

In Beppu Bay, the detailed age model to omit major events was constructed by Kuwae *et al*.(2012). Event deposits were identified by sighting based on facies, CT images, magnetic susceptibility and wet bulk density. This method can identify event deposits seamlessly, but it is a problem to depend on the personal experience and to have difficult to quantitative detection. Therefore we tried quantitative detection of event deposits by the statistical method and compared the detection result and the sighting result in Kuwae *et al*.(2012). The BP09-3 core (about 9.3 m long) using this study which was used in Kuwae *et al*.(2012) was obtained at the deepest place in the head of Beppu Bay.

Generally, because the source and sedimentation process of event deposits are greatly different from non-event deposits, chemical composition, particle composition or other profiles have difference. Therefore, in this study, we defined event deposits as " the sediment which has significantly different composition or physical properties ", we tied the quantitative detection of the event sediment using test for outliers. Analysis data are particle composition of very fine sand which sampled every 2 cm from the core, and we used MSD method (Wada, 2010) which is the robust and multivariate method for test. As a result, 47 events were detected. The detected event in this study and the sighing event in Kuwae *et al*.(2012) are relatively congruent, so it is thought that detective method using this study is useful for quantitative detection of event deposits. However, there are problems that 1) one is not to be able to detect minute event sediments enough and 2) the other is difficult to recognize the border of event deposit and non-event deposit. Because the event layer which was not able to detect is thin relative to sampling interval, it is thought that event layer was diluted by non-event deposits. Because there is no a meaningful difference in composition of the neighborhood of border, clear border detection using only test for outliers is difficult. It is necessary to evaluate and reflect event attenuation (vertical change) and preservation potential to solve these problems.

Keywords: Beppu Bay, Event deposits, Quantitative detection, Particle composition