

Climate changes over the last 2-3 kyrs recorded from the lake sediments in the lowland of the Maya, Guatemala

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We present time-series geochemical and pollen records from sediment cores taken at Lake Quexil in middle part, and Lake Petexbatun and Lake Las Pozas in south part of the Maya lowland, Guatemala, to reconstruct the climate and vegetation history of the region over the last two or three thousand years.

Three lakes as Lake Quexil, Lake Petexbatun and Lake Las Pozas, are on the Maya Lowland and possess sediments that preserve a highly sensitive record of past environmental changes related to ITCZ migration (e.g. Hodell et al., 2001) and human impacts concerned with the Maya Civilization (Johnston et al., 1998). In Feb 2011, we collected ten ca.4-m-length sediment cores from these three lakes by the Mackeleth core sampler.

Using the cores, we had firstly undertook a series of analysis, e.g., lithological observation, C-14 dating and sequential measurements of physical properties and paleomagnetism. By these analysis, we could build up the stratigraphy and chronology all for the core. Core chronology show that the age of bottom of sediment core of Lake Quexil, Lake Petexbatun and Lake Las Pozas reach up to 2,800, 3,600 and 1,450 cal. Years, respectively.

For reconstructing past climate changes, we measured total organic carbon (TOC), total nitrogen (TN), and total sulfur (TS) contents by CNS element analyzer as well as major and trace elements by ICP-AES with 2.3-cm interval bulk samples through the core. We use the total sulfur (TS) contents and the aluminum (Al) contents as an indicator of relative changes in the ratio of evaporation to precipitation (E/P), and total amount inputs of detritus minerals from the surroundings.

Basically, the fluctuation of TS and Al content for all sediment core has a negative correlation. These proxy records of Lake Quexil and Lake Las Pozas shows that lake level drop were observed at 300-400, around 500, 1700-1900, 2100-2300, 2400-2700 and 3000-3200 cal. years in both lakes, however, around 800 to 1,200 cal. years was occurred only at Lake Quexil. This discrepancy of such periods suggests that climate drought may not affect high evaporation in the south region. It is also clarified that drastic deforestation was observed around 10th century near Lake Las Pozas.

Keywords: lake sediments, Lake Quexil, Lake Petexbatun, Lake Las Pozas, drought, Maya Civilization

Cambodia, Sedimentary Environment Change at Site of Sambor Prei Kuk

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The ruins of Cambodian Sambor Prei Kuk are ancient city of the seventh century equal to the capital of the Chenla dynasty heyday, and the Chenla dynasty is placed in a development process of the Khmer civilization that built an Angkor Wat for "the pre-Angkor period". In these ruins discovered from a dense forest in 1894 by the French, it is performed comparing and drawing conclusions of by epitaphs being the ancient city Isanapura of the Chenla dynasty.

However, the documents are poor about the change that ruins followed to date, and there are many any questions because there is not the study from the field of natural science. In this paper, the ruins of Sambor Prei Kuk which was main site of the pre-Angkor period, I gathered the sediment around the ruins of Sambor Prei Kuk with a core sampler(B-trench spot, SS5 spot, SP5 spot) for the purpose of the paleoenvironmental change of the area after the pre-Angkor period and, tried to reveal from magnetic susceptibility, color, water content, XRF(X-rays fluorescence).

The B-trench spot was originally in the water area, but I was in the middle of becoming the land area, and reaching it at the present, Isanapura was constructed. The SS5 spot did not understand the details of the bottom layer, but the organic matter of wetlands deposited at constant speed, but phosphorus was supplied abundantly on the way and promoted a rise of the bioproductivity strongly. The SP5 spot was thought to be the bathing pond associated with the temple, and there was soil-stratum building soil when it was constructed 1400 years ago and it was maintained as a bathing pond and was water rich through the season. Meanwhile, there was a factor to bring a change in bioproductivity several times and, in the pond, was covered in a short term afterwards.

On the other hand, there were not clear comparison relations and was not able to evaluate the environmental change of the ruins of Sambor Prei Kuk area between the cores of three spots comprehensively. It was thought that sedimentation environment varied according to three core collection spots, and this simply discussed the local sedimentary environment change in this paper.

Keywords: paleoenvironment, sediment, Cambodia

Formation of networked flow channels in the early Holocene at Lake Tonle Sap, Cambodia

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Lake Tonle Sap is located at the central part of Cambodia, South-East Asia. The water body swells and shrinks at an annual cycle with the water depth ranging from 1 to 10 meters, affected by a seasonal water supply from the Mekong River. Thus, the lake plays an important role as a natural reservoir protecting the region from flooding. A question arises in the paleolimnological context as to how the lake has manifested the function controlling water balance. In this study, we undertook an extensive sonic survey at the lake in order to clarify the subsurface structure of Lake Tonle Sap. In consequence, we discovered deposited valleys forming a complex network of past flow channels in the early Holocene.

The survey was conducted mainly in rainy seasons from 2009 to 2012. Sediment cores were collected at three sites in dry season. Echo sounding was undertaken over the whole part of the lake using a single-channel sub-bottom profiling system (Stratabox, SyQwest Inc.). A prominent sound frequency of 10 KHz was selected in order to observe structure of reflectance planes up to the 40-m depth. The results showed that the subsurface structure of the lake bed was mostly flat with a strongly reflecting plane (#1) observed at the depth of 1-2 meters. The sediments consisted of loose mud up to the #1 plane. At the depth of 10-14 meters, a number of valley-shaped reflecting planes (#2) were observed. A 3-dimensional reconstruction of the #2 plane presented a complex network of deposited flow channels. Radiocarbon dates suggested that the valleys were formed around 10 ka calBP.

Keywords: networked flow channel, Holocene, Lake Tonle Sap

Floodplain development along the lower Stung Sen River, the Tonle Sap tributary

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The Stung Sen River, the biggest influent tributary to Lake Tonle Sap in central Cambodia is influenced by Asian monsoon climate, and seasonal precipitation changes controls hydrologic and geomorphic environment in the region. Interpretation of aerial photography showed that the Stung Sen River floodplain consists of two geomorphic units: meander belt along the meandering river channel and back marsh. Observations of outcrops and six sedimentary cores across the floodplain at Kampong Chheuteal and Kampong Thom reveal that floodplain environmental changes at c.11 ka, indicated by sand layers at Kampong Chheuteal and abundant plant materials at Kampong Thom, were associated with the Holocene onset of the southeast Asian monsoon and probably with the emergence of Lake Tonle Sap. The present back marsh-meander belt system was established about 5.5 ka along with the initiation of seasonal flow direction change of the Tonle Sap river. The meander belt materials are replaced as the river channel shifts on a decadal to centennial timescale. Back marsh sediments had a constant accumulation rate of about 0.5 mm/yr during the Holocene, contrasting with rates of 0.1 mm/yr during the late Pleistocene, at least since c.36 ka. These evidence indicate that the floodplain development of the Stung Sen River is dependent on the changes of Holocene monsoon intensity and water level changes of the most downstream Lake Tonle Sap.

Keywords: floodplain, drill core, Lake Tonle Sap, Mekong River, Cambodia

Last 2 ka climate change at Ilgaz site North Anatolian fault systems

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At the central part of the North Anatolian Fault systems, across the 1943 rupture segment, surface sediment at around 1500 m asl was obtained from Ilgaz trench wall (Sugai et al.,2000). Pollen analysis and AMS 14C dating coupled with facies analysis and geomorphic investigation revealed last 2k paleoclimate change. At Medieval Warm Period (9C-11c AD), alternation of well-sorted reverse grading thin gravel bed with lots of pine cones and thin humic silt bed developed well, suggesting that conifer forest was dominant land cover and a sheet flood of melted snow occurred repetitively under warm humid climate conditions. In contrast, in Little Ice Age (17c-19c AD) peat layer with poor sorted angular gravels deposited and herbaceous pollen was dominant. This implies that the study site was under periglacial environment and above or near the timber line.

Keywords: paleoclimate, Medieval Warm Period, Little Ice Age, pollen analysis, North Anatolia, AMS radiocarbon dating

Holocene sand dunes activities and climate changes in Central Asia

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In Central Asia, there are deserts and semi-deserts under the inter-continental arid and semi-arid climate. Saryyesik-Atyrau Desert is located as a sandy desert within the sand dunes around Lake Balkhash and Ili River delta in Southeast Kazakhstan. This research aims to clearly the relationship between the sand dunes development and regional or global environmental changes in Saryyesik-Atyrau Desert. In our previous study, the types of sand dunes in Saryyseik-Atyrau Desert were classified into three types (Dune I, II and III) that based on the wavelength, the height and the patterns (Sato et al, 2012a). Dune I and Dune II are seemed to classify Draa (known as the unit of mega-linear dune) in the Last Glacial Age. Dune III, the smallest dune unit including variety of dune type (linear, parabolic, vegetated and blow-out), covers the morphology of Dune I and II. In addition, Sato et al (2012b) suggest the development phase of Dune III during Mid-Holocene in Saryyseik-Atyrau Desert by the OSL dating results (Kondo et al (2011). Otherwise, The analyses of lake sediment core (0901core, 0902core) from Lake Balkhash shows the records of the past 8000 ka, and suggest the lake-level regression and the aridification in around Lake Balkhash (Sugai et al, 2011; Endo et al, 2012). And the some other paleoenvironmental records, from the lake sediment (Chen et al, 2008) or the alluvial sediment (Li et al, 2011) in Central Asia, suggest the sifting from humid to dry phase after the Holocene Climatic Optimum (HCO). Therefore, The sand dunes activity of Saryyesik-Atyrau Desert also seemed to be affected by the aridification in Central Asia that a part of the global climate changes from Mid to Late Holocene (Wanner et al, 2008). The climate changes (the sifting of North Atlantic Oscillation (NAO), the westerlies and Siberian high) probably forces to sift the frequency and the direction of regional previous wind and the annual precipitation in Central Asia.

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Keywords: Kazakhstan, After Holocene Climatic Optimum, Lake Balkhash

Paleoenvironmental study of the late Quaternary. based on diatom analysis of a sediment core from Lake Biwa, Japan

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To reconstruct paleoenvironment in a mid-latitude region during the late Quaternary, fossil diatom abundance and assemblage character were examined for the BIW08-B core taken from Lake Biwa. BIW08-B core is 100.3m in length and consists mainly of homogeneous silty clay except for 20-m-thick sandy sediments in the core bottom. According to an age-model based on the marker tephra beds, this core can cover over the last 300,000 years. Based on the diatom assemblage characters, the following 7 zones were distinguished stratigraphically.

Zone 1: Planktonic diatom *Stephanodiscus suzukii* is dominant.

Zone 2: Benthic diatoms such as *Navicula* spp. and *Achnanthes* spp. are dominant.

Zone 3: *Aulacoseira nipponica* is dominant.

Zone 4: *Cyclostephanos* sp. is dominant.

Zone 5: *Stephanodiscus suzukii* is dominant.

Zone 6: *Aulacoseira nipponica* is dominant.

Zone 7: *Stephanodiscus suzukii* is dominant.

These stratigraphic changes of diatom assemblage are consistent with the results of diatom analysis in the other cores. Therefore, quasi-periodic changes of aquatic environments have been occurred commonly in the whole Lake Biwa. The abundance of diatom valves also fluctuates quasi-periodically, and corresponds roughly with the temporal variation of the East Asia summer monsoon strength in periodicities of tens of thousands of years.

In order to investigate the causes of diatom assemblage change, detailed diatom analysis was performed in interval of 300 years for the sediment of the last 25,000 years, when *S. suzukii* and *A. nipponica* occupy 80% of the total diatom. Abundance of diatom valves is ordinarily poor (1.0×10^8 valves/g) until 7,000 years ago. It has much increased only after 7,000 years ago. This fluctuation is inconsistent with precipitation change or intensity variation of the East Asian summer monsoon. Diatom valve concentration may respond to climate change late, or not reply straight to rapid warming and precipitation increase.

Then, to search diatom survival strategy, the diameter of *S. suzukii*, which were dominant species in this period, was measured and its frequency distributions were analyzed for the last 25,000 years. Between 25,000 years and 12,000 years ago, total number of diatom was constantly low and frustule sizes were small (7-12 micrometer). On the other hand, the proportion of individuals of larger valves (20-30 micrometer) increased between 12,000 and 7,000 years, even though frustules abundance is still low. Diatom (*S. suzukii*) took the survival strategy to change cell size for the transitional period from the LGM to the Holocene. That is to say, *S. suzukii* changed its size in response to rapid warming and survive the competition with other diatom such as *A. nipponica*. Diatom valves variation might respond tardily to the climate change, because it takes time to shift the survival strategy.

Keywords: Lake Biwa, Late Quaternary, Diatom, Frustule size, *Stephanodiscus suzukii*

Potential of summer temperature reconstruction using tree-ring chronology of Japanese beech at the Shimokita Peninsula

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Various archives such as tree rings, ice cores, varves and historical documents have provided effective proxy data for unraveling the past climatic variability. Tree rings have given annually-resolved quantitative reconstructions of the past temperatures, precipitation, drought indices and other climatic parameters. Although there have been recent efforts to improve the coverage of dendroclimatic reconstructions in the East Asian region, tree-ring records are still sparse in Japan. It is worth developing tree-ring chronologies for investigating the dendroclimatic potential. The purpose of this study is to investigate temporal stability of climate-growth relationship for Japanese beech (*Fagus crenata*) for the northernmost Honshu Island and to investigate its potential to reconstruct past climate.

We used a tree-ring record of Japanese beech at the Shimokita Peninsula, the northernmost part of the Honshu Island. The standard techniques of dendrochronology were employed for chronology building. The climate-growth relationships were estimated using boot-strapped response function analysis. The response function shows that the ring width correlates positively with previous warm-season temperature. This suggests that the optimal growth of Japanese beech depends on an above-average hot summer in the previous year. The summer temperature was preliminary reconstructed, using a multiple linear regression model. The performance of the calibration model was validated by the standard cross calibration-verification method. As a result, the calibration model shows that the Japanese beech chronology have enough potential to reconstruct the past climatic variability.

Keywords: dendroclimatology, summer temperature reconstruction, *Fagus crenata*

Sedimentary environment during 3000 years recorded in the piston core sediments of Beppu Bay, central Kyushu, Japan

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Beppu Bay is located at the northeast end of the region called the Beppu-Shimabara graben (Matsumoto, 1979) in the central Kyushu, Japan. According to Itoh et al. (1998), the formation process of Beppu Bay region is divided into two stages (Stage 1 and 2); especially pull apart basin started in Stage 2 after 1.5Ma and has been subsiding. Therefore continuous thick sediments of terrigenous, chemical/biogenic and cosmogenic/volcanogenic origin were deposited. The continuous analysis at the close interval is important to recognize a change of the sedimentary environment and the event sediment which affects the age depth model. We examined sedimentary environment of the bay using piston core (BP09-3) which were obtained in the southern part of head of the bay. In the southern part of the bay, high accumulation rate and high preservation potential are expected because here is the place the deepest part in the bay and is reductive sedimentary environment.

Piston core was about 9m length, and firstly soft X ray CT scanning, a magnetic susceptibility measurement and a color profile measurement were carried out. We cut piston core into pieces every 2cm and got 457 samples. The samples were fractionated by a mesh cloth. The particle composition was considered using the particle of very fine sand (3-4phi) under the polarization microscope. The particle was classified in heavy mineral, light mineral, volcanic glass, diatom, plant particle, rock fragment and others and were counted more than 200 particles. The age depth model used the model in Kuwae et al.(2012) which was decided using the multiple cores in the same point.

The core mainly consisted of mud, and accumulation rate was 230-300cm/ky. Marine diatom particles were observed in all samples and occupied more than 90% in some cases. The abundance ratio of diatom decreased and rate of particle excepted diatom increased at some horizons, and the composition changed abruptly. We call a series of samples with abrupt change of composition "event sediment". "Event sediment" was commonly revealed as increasing of abundance of coarse sediment, and some case without the change of a particle size. "Event sediments" has different grain composition.

Many diatom particles are included in the sediment, and diatom is main deposits in the very fine sand fraction in a common bay environment. It is considered that the decrease of abundance of diatom grains was diluted by "event sediment" because the abundance of diatom has a negative correlation with that of volcanic glass. Since the event sediment is detected from a sample without a remarkable particle size difference, not only the particle size but also the composition is important to examine the event sediment. The difference in the composition of each "event sediment" is related to source of particles, and also vertical change by particle type may be reflected the behavior of each particle type in transportation and sedimentary process. The frequency of the event sediment is different during 3,000 years. We need discuss on the type of "event sediment" from the viewpoint of type of event such as earthquake, flood, volcanic fall, turbidite and etc.

Keywords: Beppu Bay, sedimentary environment, event sediment, holocene, grain composition

Relationship between active fold and slope collapse by earthquake in Shinano River Tectonic Zone

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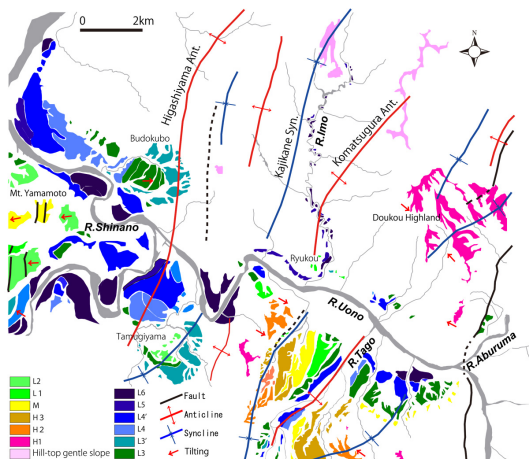
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We discuss the relationship between active fold and slope collapse in Shinano River Tectonic Zone. Fig.1 shows the distribution of terrace and geological structure around Uono River. The oldest terrace H1 which was formed over 300ka covered by Iz-Kt tephra is distributed in Doko highland. The terraces from over 300ka (H1 terrace) to recent (L6 terrace) are distributed on the left bank of Uono River, however, new terraces (L3-L6 terrace) are only distributed near the junction of Uono River and Shinano River. Since the amount of uplift of this area was large, about 1m uplift was measured in the 2004 Niigata-ken Chuetsu Earthquake. As the axial of Higashiyama anticline is located in this area, we considered the growth of active fold was occurred by this earthquake. In the Imokawa River basin, the terrace covered by Ab-t1 tephra (Imokawa 3 terrace) was identified with L5 terrace, and the terrace not covered by loam (Imokawa 5 terrace) was identified with L6 terrace.

In the 2011 Nagano Niigata Border Earthquake, the slope collapse and road deformations were concentrating by the hanging wall side of a reversed fault. Since these distributions of deformations are dominated by anticline and syncline structure and GPS data shows uplifting of the shape of a dome by the side of a hanging wall, a possibility of the growth of active fold in this earthquake can be suggested.

Fig.1 Distribution of terrace and geological structure around Uono River

Keywords: active fold, slope collapse, Imokawa River basin, Chuetsu Earthquake, Nagano Niigata Border Earthquake



Reconsideration of the Age of Zenkoji Debris Avalanche Deposits

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A great number of hummocks of the Zenkoji debris avalanche are distributed over the southern slope of Usu volcano, south Hokkaido. The hummocks are divided into two types: one is composed of lava blocks of the earlier stage of Usu volcano, and the other of Toya pyroclastic flow deposits (Soya et al., 1981). In previous studies, it has been suggested that the age of the Zenkoji debris avalanche deposits was around 7,000 - 8,000 years ago, because archeological sites of the Early Jomon Period were found on the Zenkoji debris avalanche deposits (Katsui et al, 1973 ; Katsui, 1988 ; Kosugi, 2007).

Several alluvial lowlands distribute among the hummocks. We took two boring cores from the lowland between hummocks of Toya-type, near the coast, east of Arutori Misaki. The cores about 10 m long, mostly consist of peat and organic clay, showing continuous sequence. At the bottom of the core, hard pumiceous deposit having the same chemical composition of the Toya pyroclastic flow was found. In the lowest horizon, small pumiceous blocks were intercalated in organic clay.

At least two tephra, Ko-g (from Komagatake, 7,000 y. BP) and Ng (from Nigorikawa caldera, 15,000 y.BP) are identified in the upper and the lower organic clay of the cores. Age determination of the peat and organic clay samples were done by AMS C-14 method. The result shows about 20,000 cal. BP. for the organic clay of - 8.7 m. Pollen analysis for the peat and organic clay clarified that the subarctic coniferous forest was dominant in the lower half of the core, and the Younger Dryas event can be detected from - 6.6 m to - 6.7 m.

Therefore , these facts suggest that the age of the Zenkoji debris avalanche deposits and the collapse of the Usu volcano must have been LGM (the last glacial maximum).

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Keywords: Usu Volcano, Zenkoji Debris Avalanche, Drilling, AMS Dating, Tephra

Heavy metal pollution in Ancient Nara, Japan, during the 8th century

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We quantitatively investigated 8th century heavy metal pollution in Heijo-kyo (Ancient Nara), the first large capital of Japan. In this city, mercury, copper, and lead levels in soil were increased by urban activity and by the construction of the Great Buddha statue, Nara Daibutsu. Mercury and copper pollution accompanied the construction of the statue, with a great influence on its immediate area but a much lesser influence on the wider city environment. Accordingly, we reject the hypothesis that severe mercury pollution brought about by the construction of the Nara Daibutsu made it necessary to abandon Ancient Nara. High lead pollution was detected at several sites. The isotopic composition of the lead indicated that it originated mainly from the Naganobori mine.

Keywords: Hg pollution, Cu pollution, Pb pollution, Heijo-Kyo, the Great Buddha, Naganobori mine

An 802-year tree-ring chronology from Hatchobori 3-chome Site, Chuo-ku, Tokyo

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Dendrochronology is the science of dating tree rings, widely used to address environmental and historical issues. Despite the recent advance in chronology building, long tree-ring chronologies are still sparse in East Asia, including Japan. The purpose of the present study is to build a new long ring-width chronology of cypress species, from wooden remains recovered from an archaeological site in eastern Japan.

A large number of tub-shaped and box-shaped wooden coffins were excavated from Hatchobori 3-chome Site, Chuo-ku, Tokyo. The site dates the early half of the 17th century. The tub-shaped wooden coffins were mainly made of *Chamaecyparis pisifera* (Sawara cypress). According to wood identification, along with pollen and historical records, Suzuki and Noshiro (2004) deduced that the timbers were imported from the Kiso and Tenryu valleys.

71 boards from the tops, bottoms, or sides of the coffins were selected for tree-ring measurement. Of the 71 samples, 38 were visually and statistically crossdated based on standard procedures in dendrochronology. An 802-year raw ring-width chronology (from the 9th century to the 17th century) was successfully constructed. Mean t-value between the chronology and samples was 10.5, indicating high coherency among the tree-ring series.

The chronology was successfully crossdated with other chronologies from archaeological sites in Tokyo, indicating high t-values. For example, $t = 13.8$ with the chronology from the Mirokuji site, early Edo period, also consists of coffin boards mainly made of Sawara cypress. This result may indicate that timbers from those sites were imported from a certain limited area.

Further efforts should concentrate on obtaining fully continuous chronologies covering the last 2,000 years for tree-ring dating and climatic reconstruction.

Keywords: dendrochronology, chronology development, Sawara cypress, Edo period

Revealing the History of Akita-sugi forest by Pollen Analysis on Lake Ichi-no-Megata, Akita Japan

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Akita-sugi (Akita Japanese cedar: *Cryptomeria japonica*) forest is considered to be one of the most beautiful forests in Japan. It has a long history of utilization and during the history, the forests were exploited severely and now a part of forests is conserved. It is said that the forest of the Tohoku area including Akita prefecture had been logged by AD1700. Deforestation was caused not only for timbers but also for reclamation of land. Although the coverage of forest in Akita prefecture is over 60%, natural forests of Akita-sugi cedar forests are now remained and preserved in small areas, e.g. Nibetsu in Akita city. Recently annual laminated sediments have drawn attention and the analyses of them have made possible to understand the detail of environmental changes. In this study, the pollen of annually laminated sediment core from Ichi-no-Megata Lake in Oga peninsula, Akita was analysed to understand the history of Akita-sugi cedar forest.

Lake Ichi-no-Megata is located in Oga peninsula, Akita prefecture. The climate of the region is on the boundary of cool temperate and warm temperate region. The vegetation of natural forest is summer green broad-leaf forest dominated by *Fagus crenata*, but now it is substitutional community in *Fagus crenata* region and the area is mainly occupied by secondary forest of *Quercus serrata*, plantation of *Pinus densiflora*, *Cryptomeria japonica* (sugi cedar), *Chamaecyparis obtusa* (hinoki cypress) or cultivated land due to the human activity from the old time. Over 150 archaeological sites from Jomon to Yayoi period has been identified in Oga peninsula. An oral tradition and historical records indicate that human beings have been involved in the vegetation change around the area from the ancient time.

Coring campaign was conducted in 2006. An absolutely continuous core (IMG06) was taken. About 30,000 years of sediment was recovered. Age-depth model was drawn based on 74 plant macrofossil samples dated by an accelerator mass spectrometer (AMS) at the Poznan Radiocarbon Laboratory and tephra. Pollen samples taken every about 5-10 years excluding turbidite layers. We focused on the top part, about last 4000 years in this study. Pollen was extracted and was examined and then, the percentages of these pollen sums were calculated based on the total of terrestrial pollen and then percentage pollen diagrams were constructed. Pollen concentration (grains/cc) diagrams were also constructed based on the added and counted marker grains.

Dominant pollen taxa were *Cryptomeria* and *Fagus crenata* type by AD1150. The first increase of *Cryptomeria* was detected around 1500BC. Akita-sugi forest has been established from this time. At that time, the vegetation was mixed with deciduous trees, mainly *Fagus crenata*. *Cryptomeria* pollen was the most abundant in AD100-AD1000. During 12th century, the main deforestation activity was observed. Gramineae and *Artemisia* pollen increased in both percentages and concentration. It indicates that land reclamation for rice paddies occurred. Still *Cryptomeria* forest was mixed with deciduous trees and in 16th century, forest resources were exhausted. Entering Edo period, mine development was active. These were recorded in pollen. After that, forest was conserved by law. However until 19th Century, *Cryptomeria* pollen was low in both percentages and concentration. There was severe famine caused by Little Ice age during 18th century. In addition, trees were harvested when big fires occurred in Edo. These events seemed to prevent from the recovery of forests. After the severe famine periods, conservation activity was high and plantation of *Cryptomeria* occurred, but deciduous elements in the forests have much less than before. The landscape has changed completely by deforestation and plantation during the historical time.

Keywords: Ichi-no-Megata, pollen analysis, deforestation

Analysis of ^{14}C age calibration data sets based on tree rings from Japanese wood

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Radiocarbon (^{14}C) dating is widely applied to archeological materials and cultural properties that are sometimes closely related with historical events. In particular, ^{14}C dating is utilized to decide whether the materials are really related with the historical events, and highly accurate dating of the samples is required to judge the real from the false for history-related materials. Accuracy of ^{14}C dating results is determined largely by appropriateness in sample preparation and measurements of ^{14}C abundance of the prepared targets, but it is also related with the procedures to obtain reliable calendar age in calibration of sample conventional ^{14}C age. For ^{14}C age calibration, the IntCal09 data sets are normally used for terrestrial samples whose carbonaceous fractions were synthesized from atmospheric CO_2 in the Northern Hemisphere, while the SHCal04 data sets are used for those in the Southern Hemisphere.

The accuracy of calendar age that was obtained by calibration of ^{14}C age with IntCal09 data sets (Reimer et al. 2009) is, however, sometimes questioned because of the possibility that ^{14}C concentration in atmospheric CO_2 may vary spatially (Imamura et al. 2007). The calibration data sets IntCal09 are established on the basis of ^{14}C data for tree rings grown in North America and Europe, but do not include those for the tree rings grown in other areas, for example, in Japan, although ^{14}C data for plant residues from the bored cores at Lake Suigetsu, Fukui Prefecture, Japan, will be incorporated in the age range of 11.2-52.8 ka BP in the latest calibration data sets (Bronk Ramsey et al. 2012). The Japanese archipelago is located at the eastern margin of the Asian continent in the middle or a bit lower latitude region, and the ^{14}C concentration in atmospheric CO_2 over Japan may be lower than that at inland areas and northern locations as in North America or Europe, as the result of CO_2 release to the atmosphere from the near-by ocean surface which has a lower ^{14}C concentration, or air-mass delivery over the Pacific Ocean by East Asian monsoon in summer season when the plants grow quickly.

To investigate the ^{14}C concentration of atmospheric CO_2 in the past few millennia over Japan, we measured ^{14}C ages of annual rings on a single year basis from three Japanese trees whose calendar dates range from ca. 2000 years old to present, and compared the tree-ring ^{14}C ages with corresponding ^{14}C ages of IntCal09. It was revealed that ^{14}C ages of annual rings from Japanese trees are not consistent with IntCal09 data sets. Many ^{14}C ages of tree rings are older than those of IntCal09, but younger than those of SHCal04 data sets. The average shifts of Nagoya ^{14}C ages from IntCal09 ones and one-sigma errors were obtained to be $+26\pm 36$, $+24\pm 30$, $+16\pm 22$, $+5\pm 21$ and $+14\pm 22$ ^{14}C years, for the intervals of AD72-382, AD589-1072, AD1413-1615, AD1617-1739 and AD1790-1860, respectively. IntCal09 data sets are usually preferred for calibration of ^{14}C ages from Japanese samples, but it is revealed that SHCal04, or maybe a modified intermediate version of IntCal and SHCal, is rather suitable for Japanese samples in some cases. The Japanese archipelago is situated near the boundary of the Inter-tropical Convergence Zone in summer season, and the ^{14}C concentration of atmospheric CO_2 over Japan can be influenced by air masses of the Southern Hemisphere with lower ^{14}C concentrations during the period of higher solar activities and magnified East Asian summer monsoon. Our results suggest that the Japanese archipelago is located in the critical zone where it is difficult to calibrate the ^{14}C ages of tree ring samples collected with existing calibration data sets. At the moment, it should be noted that calibration of ^{14}C dates of Japanese samples with IntCal09 may induce additional systematic shifts of calibrated ages toward older ages by about 30 years, from the sample optimum calendar ages.

Keywords: ^{14}C age, calendar date, calibration to calendar date, tree ring, solar activity, Pacific high barometric pressure

Transition of timber usage in 17-19th century deduced from materials of coffin boards at Sugen-ji graveyard site, Tokyo

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Over the large part of the Japan's main islands, the use of forest resources had changed in Edo period. During the early half of the 17th century, timbers were produced from natural forests for constructing castles and cities, resulting in depletion of wood throughout Japan. Later on, felling activities were banned by law associated with efforts to regenerate forests by plantation. The enhanced measure of forest protection might have greatly affected to the pattern of timber consumption in cities. However, lack of documented records makes it difficult to reconstruct the historical change of timber use during the time period. Wood artifacts from urban archaeological sites can be a promising material to overcome this issue. In this study, we collected coffin boards used in the graveyards for commoners at the Sugen-ji archaeological site, Tokyo. The samples were dendrochronologically dated and the species were identified. The results will show the transition of timber use in the city of Edo during the 17-19th century.

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Keywords: Tree-ring dating, Edo, timber usage, coffin, wood species

Regional variability on the 'Southern Route' of modern human dispersal into Eurasia

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The "Southern Route"- from East Africa to South Asia, via the Arabian Peninsula- is now most popular hypothesis on modern human dispersal into Eurasia (better-known as 'Out of Africa', ca.120~50ka (Petraglia et al. 2010). Survey and excavation of archaeological sites in both Arabia and India have been rapidly progressing over the last decade, while timing and frequency of 'Out of Africa' is under controversy. The major discoveries are as follows: 1) Nubian industry in Southern Arabia which is similar to that of North and East Africa (ca. 100ka.: Rose et al. 2011); 2)Leptolithic industry which is subsequent to the Nubian in Southern Arabia (40~8ka: Hilbert et al. 2012); 3)Levallois-like industry in Eastern and Southern Arabia (e.g. FAY-NE Assemblages B and A, ~30ka: Armitage et al. 2011; SD1, 55ka: Delagnes et al. 2012), 4)Microlithic Rostamian industry in Southwestern Iran (41~35ka.cal.BP: Conard and Ghasidian 2011), 5)various mode III assemblages of South Asia (90?~40ka: Petraglia et al. 2012), 6)scraper dominant assemblages in Pakistan and Central, West India (e.g. 16R dune: ~26ka: Misra 1995), 7)South Asian microlithic industry in Central, South India and Sri Lanka (36ka~: Perare et al. 2011). However fossil records are recovered only from Sri Lankan and South Indian sites associated with microlithic industry. Those microlithic industry has typical artifacts which are considered as indicators of modern human behavior, such as backed blades, stone or ostrich egg-shell beads, ocher fragment with geometric engraving, as well as bone-antler objects. The oldest dating of South Asian microlithic industry shows is around 3.6ka (cal BP) and appears to be younger than fossil records or archaeological remains of modern human from Southeast Asia and Oceania. On the other side, there is no clear evidence of microlithic technology on the way from East Africa to South Asia for the moment, with exception being Rostamian industry in Southwestern Iran. A regional patchy pattern of archaeological evidences becomes apparent with sorting of recent discoveries into tempo-chronological sequences and the distributional pattern of microlithic/ non-microlithic industries seem to correspond well to regional differences of palaeoenvironment (see Petraglia et al. 2010: fig.3). The modern human is considered to have adapted to diverse ecological niches before Out of Africa. Therefore it is also possible to consider that the patchy pattern on distribution of microlithic/ non-microlithic industries from Arabia to South Asia would indicate mosaic of different behavioral phenotypes of modern human in various environments rather than coexistence of different human groups in parallel. Recently authors have been studying Palaeolithic sites in Veesar Valley, Sindh, Pakistan, with the above-mentioned perspective (Noguchi et al. 2012). The sites are located in crescent dunes of the western fringe of the Thar Desert. Assumed Middle/ Upper Palaeolithic assemblages excavated from the strata likely correspond directly to the site surface during the formation of the dune. Dating, palaeoenvironment and geomorphology of the sites are expected to lead to further understanding of adaptive strategies of the modern human in diverse ecological niches on the 'Southern Route'.

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Keywords: Out of Africa 2, Southern route, Middle/ Upper Palaeolithic, Patchy distribution of lithic industries, Ecological niches, Adaptive strategy

The lithic raw material network of the coast of the Japan sea region in the early upper palaeolithic

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The early Upper Palaeolithic is characterized by the presence of the Palaeolithic stone axe (PSA), which has its calibrations ¹⁴C age are ca. 38,000-29,000 cal yB.P. On Japanese islands, the layers in which this axe is found lie below the Aira-Tn tephra (AT) layer. Eight hundred or more PSAs have now been reported throughout the entire country.

The following examinations of each of the available 342 PSAs were made:

- a) stereomicroscope observation, b) measurement of specific gravity, c) a magnetic test, and
- d) a measurement of magnetic susceptibility. The results may be summarized as follows.

The lithic raw material of the Palaeolithic stone axe (PSA):

The Chiba area- The vast majority of the stones called serpentinite are greenstone (basaltic tuff origin and basalt origin) and amphibolite. The coast of the Japan sea region- The vast majority of the stones called serpentinite are tremolite rock (nephrite and semi-nephrite). In comparison to serpentine, the tremolite is a denser and hard, tough, and less magnetic mineral, which lends itself better to the making of these axes.

Place of origin of tremolite rock:

Tremolite rock is produced on the following four serpentinite rocks of the Omi-Renge area: 1) along the Himekawa main stream; 2) in the Omi area, 3) along the upper stream of the Oodokoro river ~ Mt. Asahidake, and 4) in the Hakuba-happou area. Large stones of tremolite rock with an unevenness in the surface used as the material of the stone tool can be found in the Matsukawa Valley in the Hakuba-happou area.

The lithic raw material network of the Coast of the Japan Sea region:

The PSAs from tremolite rock of the Omi-Renge area spread to the Coast of the Japan Sea region, including the Toyama area (the Uwadaira I site and the Shiraiwa-Yabunoue site), Nojiri-ko sites (the Hinatabayashi B site, Kannoki site, and Nakamachi site), Iiyama city (the Taishibayashi site), Shibata city (the Sakanosawa C site), and Akita city (the Jizouden site).

In light of the lithic raw material of the stone axe, the origin of the stone network with the coast of the Japan Sea region was the early Late Palaeolithic.

Keywords: upper palaeolithic, the coast of the Japan sea region, the lithic raw material, stone axe, tremolite rock