# Short-term fluctuations in local radiocarbon reservoir age reconstructed from corals in the Ryukyu Islands

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High-resolution radiocarbon ($^{14}C$) dating is required in palaeoclimatology, palaeoseismology and archaeology. However, previously reported local reservoir age (ΔR) values have discrepancies in the Kuroshio region, which makes problems when accurately calibrating $^{14}C$ ages to calendar ages of marine samples. We measured radiocarbon dating of *Porites* corals from Ishigaki and Kikai Islands, which lie within the path of the Kuroshio Current off southern Japan, to determine local reservoir effect there. We found that the average ΔR from 1947 to 1950 for samples from Ishigaki Island was −36.0 years, which is consistent with the average ΔR value from 1901 to 1948 that we obtained for samples from Kikai Island. On the other hand, high-resolution ΔR data from Ishigaki Island for 1947 to 1950 fluctuated over a range of more than 150 years, from −136 ±42 to 62 ±50 years. Our compilation of new ΔR data and previously published data from the western Pacific indicates a strong positive-to-negative shift in ΔR during the period from 1900 to 1950. This shift of the local marine reservoir effect will affect calibration of $^{14}C$ ages to provide calendar dates in the Western Pacific.

Keywords: Radiocarbon, Corals, western Pacific, local marine reservoir age

 

# Floodplain evolution in the Shiribeshi-toshibetsu River lowland, Hokkaido

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Low-gradient, fine-grained floodplains generally evolve by aggradation of fluvial deposits such as overbank deposits and crevasse-splay deposits. Therefore, the depositional history of these deposits has attracted much attention in studies of fluvial geomorphology and geology. However, few studies have constructed detailed chronologies of floodplain evolution, and the influence of sea-level and climate changes at submillennial time scales is not clear. This study investigated the Holocene evolution of the floodplain in the Shiribeshi-toshibetsu River lowland, Hokkaido, and reveals the impact of sea-level and climate changes on the floodplain evolution.
The Shiribeshi-toshibetsu River has a catchment area of approximately 720 $km^2$, and its current length is about 80 km. The floodplain of the Shiribeshi-toshibetsu River is about 2 km wide, and its northern and southern edges are bordered by uplands and terraces. Oxbow lakes are common in a well-defined meander belt near the present channel, and there are six large peatlands outside of the meander belt. The peat are 3–6 m thick.
Thirteen sediment cores were collected from four peatlands with a hand auger that recovered sediments from depths of up to 5 m and samples were collected at intervals of 5 cm. Loss on ignition was measured at intervals of 10 cm to quantitatively classify peat and organic-rich mud. Radiocarbon dating was conducted on plant and wood fragments and twigs using accelerator mass spectrometry. Two cross sections were constructed from existing columnar sections to show the stratigraphy beneath depths penetrated by hand augers.
The auger cores and cross sections demonstrate that thick and laterally continuous peat beds overlying fluvial deposits predominate in the uppermost part of the Holocene deposits. These relatively coarse deposits in an aggrading floodplain are likely natural levee deposits or crevasse-splay deposits, and the abandonment of crevasse splays and natural levees may have led to the peat formation. A radiocarbon age suggests that the peat initiation locally predates 6500 cal BP. Peatlands continued to expand until they reached their greatest extent at ca. 4000 cal BP. The similarity of peat onset ages at some sites in different areas suggests that a strong allogenic control reduced fluvial activity and led to the abandonment of crevasse splays and natural levees at ca. 5300–5000 and 4100–3900 cal BP.
The two periods of peat initiation at ca. 5300–5000 and 4100–3900 cal BP may correspond to decreases in precipitation from the weakening of the East Asian summer monsoon (EASM) at ca. 5600–5000 and 4000–3500 cal BP. The decreases in precipitation from the weakening of the EASM have been reported from many stalagmite records. Furthermore, decreases in the strength of the EASM at these times have been inferred from pollen records and lake-level records from multiple proxies. The continuation of peat accumulation after 4000 cal BP is consistent with the decreased precipitation after the events. Therefore, decreased precipitation may have reduced the water discharge from the upstream catchments, which in turn may have resulted in the abandonment of crevasse splays and natural levees. A similar fluvial response in the Ishikari lowland, Hokkaido, has been attributed to the weakening of the EASM.
On the other hand, the evidence in this study indicates that peatlands were moderately widespread before the inferred weakening of the EASM. In general, rapid sea-level rise during the early Holocene induced rapid aggradation of coastal floodplains through frequent crevassing and avulsion. Therefore, it is considered that aggradation slowed along with the pace of sea-level rise after ca. 7000 cal BP. The local peat initiation before 6500 cal BP in the lowland may be strongly associated with the deceleration of

 

sea-level rise.

Keywords: floodplain, peat, sea-level change, climate change, East Asian summer monsoon, Holocene

 

# Environmental change from diatom analysis since MIS7~MIS8 in the Omoikawa lowland, the Kanto plain

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Omoikawa core( N36°14’ 51.19” E139°41’ 59.4”, 14.75m above sea level) was taken from the Omoikawa lowland ,located just the northern side of Watarase Basin.
The core, 60 m long, is composed of 3 sand and mud layers (A,C,E) and 3 gravel layers (B,D,F), as A to F from the top to the bottom.
From Unit A, two $^{14}C$ ages in Holocene were obtained. Diatom analysis for Unit A indicated freshwater environment.
Diatom analyses for Unit C showed mainly inner bay environment, along with marine to brackish tidal environments. It is supported by sulfur analysis. Unit C is probably correlated to MIS5e.
Unit D, gravel layer below Unit C, may be MIS6.

Keywords: diatom analysis, Omoikawa

 

# Tephrochronology of the lowest Kazusa Group distributed in the Boso Peninsula, Chiba Prefecture , Japan

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The Kazusa Group distributed in the Boso Peninsula, Chiba Prefecture, Japan.
In order to characterize the tephra layers with in the lowest Kazusa Group, authors investigated the thickness, color, shape of volcanic glass, mineral composition, refractive index of volcanic glass and the majer and trace element composition of volcanic glass. Two tephra layers in the Namihana and the Katsuura Formation of the lowest Kazusa Group can be correlated with tephra layers of the other Plio-Pleistocene Groups in central Japan. The KW1 and KW2 tephra layers in the lowest Kazusa Group are correlated with the Jwg3-Okr10 tephra(2.388 Ma) and Fup-OK2 tephra(2.2-2.3 Ma). The age of the lowest Kazusa Group is about 2.4 Ma by these tephra correlations.

Keywords: Kazusa Group, Age, Namihana Formation, Katsuura Formation, Widespread tephra correlation, Tephrochronology

 

# Correlations of the Takeyama-Ks10 and Hegawa-Ks5 tephras, two Middle Pleistocene widespread tephras derived from southern Kyushu, SW Japan

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This study shows the correlations of the Middle Pleistocene widespread tephras derived from southern Kyushu, southwest Japan. Two Middle Pleistocene widespread tephras referred to here as Takeyama-Ks10 (Tkym-Ks10) and Hegawa-Ks5 (Hgw-Ks5) have been newly recognized.
The southern Kyushu caldera region composed of the several large calderas, located in southwest of the Japanese islands, is one of the most active volcanic regions providing voluminous widespread tephras. Eight widespread tephras have been reported from the southern Kyushu caldera region since 1 Ma. Five of them occurred in a cluster after the eruption of the Kakuto tephra (330–340 ka). Compared with the tephras of the Late Pleistocene to Holocene, widespread tephras of the Early to Middle Pleistocene ages have not been well studied. On the other hand, four widespread tephras (Ks18, Ks11, Ks10 and Ks5, in ascending order), which are thought to derive from southern Kyushu, are intercalated in the Kasamori Formation of the Kazusa Group, in Boso Peninsula, central Japan. Among them, Ks10 and Ks5 have uncertainties of identification and their correlations as a widespread tephra. Although Ks10 and Ks5 are broadly recognised in southwest to northeast Japan as distal ash fall deposits, the proximal pyroclastic flow deposits (PFDs) of Ks10 and Ks5 has not yet been determined in Kyushu Island. Moreover, there are petrographically similar tephras to these two tephras, which leads to difficulties and mistakes in the widespread correlation.
In southern Kyushu, we newly defined two PFDs: Takeyama (Tkym) and Hegawa (Hgw) PFDs, in ascending order. Tkym and Hgw are stratigraphically above the Kb-Ks tephra (Kb-Ks). Based on the petrographic properties including the glass chemistry, we examined their correlations with Ks10 and Ks5. Tkym-Ks10 was identified using a combination of refractive indices and major element chemical composition of glass shards (n=1.498-1.501, $SiO_2$: 78.3-78.6 wt.%, $TiO_2$: 0.2-0.3 wt.%, $Al_2O_3$: 12.2-12.4 wt.%, FeO: 1.0-1.1 wt.%, CaO: 1.1 wt.%, $K_2O$: 2.9-3.0 wt.%, $Na_2O$: 3.4-3.6 wt.%) and mineral assemblage composed of abundant hornblende and few biotite and quartz. On the other hand, Hgw-Ks5 was identified using a combination of refractive indices and major element chemical compositions of glass shards (n=1.504-1.506, $SiO_2$: 77.2-77.5 wt.%, $TiO_2$: 0.3-0.4 wt.%, $Al_2O_3$: 12.6-12.7 wt.%, FeO: 1.4-1.5 wt.%, CaO: 1.3-1.4 wt.%, $K_2O$: 2.9-3.1 wt.%, $Na_2O$: 3.4-3.7 wt.%) and mineral assemblage composed of orthopyroxene and relatively few hornblende.
Based on previous isotope stratigraphy studies, the eruptive ages of Tkym-Ks10 and Hgw-Ks5 are 480–530 ka (MIS 13) and 430–450 ka (MIS 12), respectively. The apparent volume of each tephra estimated from the distribution area and thickness of the co-ignimbrite ash fall deposits (CAFD) is approximately > 100 $km^3$, assuming that each CAFD originating from the Aira Caldera is distributed concentrically. Therefore, a Volcanic Explosivity Index (VEI) of 7 was assigned to the eruptions. Eight widespread tephras derived from the southern Kyushu caldera region during the last 600 ka, Smkd-Ks18 (part of former Hwk), Kb-Ks, Kkt, Ata-Th, Ata, K-Tz, AT and K-Ah tephras, in ascending order, had been reported. This indicates that eruptions accompaning huge pyroclastic flow deposits (VEI 7) occurred at an average interval of about 75 kry as the whole Kagoshima Graben. However, considering two newly defined widespread tephras Tkym-Ks10 and Hgw-Ks5 positioned between Kb-Ks (530 ka) and Kkt (340 ka) from Kb-Ks to Kkt eruptions, the frequency of large caldera eruption (VEI 7) through the past 600 ka was

 

revised to once in 60 kyr on average. In addition, focusing on the eruption interval in detail, the interval has changed at Hgw-Ks5 eruption. During the period of 500 kyr from Smkd-Ks18 eruption to Ata eruption (105 ka), the average interval of large-scale eruption in the Kagoshima Graben had become longer from 40 to about 100 kyr after the Hgw-Ks5 eruption.

Keywords: widespread tephra, Middle Pleistocene, correlation, southern Kyushu, Kasamori Formation

 

# Dawson Tephra in the sedimentary core collected at the Patton Seamount, off the Alaska Peninsula

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This study reports tephras in the giant box core SO202-27-6 collected at the Patton Seamount off the Alaska Peninsula during the research cruise SO202-INOPEX in 2009. It was collected on the Patton Seamount at the latitude 54°17.77’ N, the longitude 149°36.01’ W and the bottom of the sea which is 2919 m. The core consists of the pelagic ooze, and its length is 2.92 m. There are two tephra layers, which the upper layer (Sample ID93 and ID94) is sub bottom depth 119-122 cm and the lower layer (Sample ID95) is sub bottom depth 135-138 cm. ID93 tephra sample is well-sorted and normal grading whitish gray volcanic ash layers which maximum diameter of grain size is approximately 3 mm, and including some lithic fragments which diameter is about 9 mm. ID95 tephra sample is crystal rich layer including fine volcanic glass shards.
Electron microprobe analysis determined the major element composition of volcanic glass shards in ID93 tephra sample. Geochemistry of ID93 tephra is rhyolite and very similar to Dawson tephra (ca. 27 ka) in Mangan et al. (2003). Furthermore, geochemistry of ID93 tephra sample determined by the X-ray fluorescence is also close to geochemistry of whole-rock analysis of pumices (Mangan et al., 2003). Dawson tephra was provided from the Emmons Lake volcano on the Alaska Peninsula in the last glacial maximum, and found in loess deposits on west-central Yukon Territory. This is the first discovery that Dawson tephra distributes over the Pacific Ocean.

Mangan et al. (2003), Emmons Lake Volcanic Center, Alaska Peninsula: source of the later Wisconsin Dawson tephra, Yukon Territory, Canada. Canadian Journal of Earth Science, 40, 925-936.

Keywords: Dawson tephra, the Alaska Peninsula, sedimentary core

 

# The world’s OLDest pottery and stone arrowheads appeared in the cOLD est climate in the cOLD area in Japan

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The first emergence and development of pottery is an important archaeological research topic. Climate change and the associated ecological changes likely promoted the development of pottery. However, little is known about these environmental factors at regional scale. Sedimentary core MD01-2409 collected off the coast of northern Honshu, Japan, provided a good opportunity to quantitatively estimate paleo-temperatures using the alkenone proxy because of the positive correlation between atmospheric and sea surface temperatures. The earliest pottery found in Japan was excavated at the Odai-Yamamoto I site and its age was approximately 15.5-16.5 thousand calendar years before present (cal. kyr BP), when the climate on the island was the coldest one which the Jomon people had experienced due to weakened the Asian Summer Monsoon influenced by one of the global effects of Heinrich Event I. The atmospheric temperature was approximately 7~11˚C lower than it is currently, which was a little colder than those at present-day Nemuro and/or Nosappu cities in Hokkaido. Subsistence in a terrestrial environment and plentiful marine products such as fishes and shells are consistent with the evidence that the earliest pottery was predominantly used for cooking marine and freshwater resources and increased diversification in the range of aquatic products used. Although the relationship between climate and the appearance of pottery in Japan may not be direct, the earliest pottery and projectile points (stone arrows) in the world are associated with the coldest period that Homo sapiens experienced since arrive in very cold region of the Japanese archipelago.

Kawahata, H., Ishizaki, Y., Kuroyanagi, A., Suzuki, A., Ohkushi, K. (2017) Quantitative reconstruction of temperature at Jomon site in the Incipient Jomon period in northern Japan and its implication for the production of early pottery and stone arrowheads. Quaternary Science Reviews, 157, 66-79.

Keywords: Sea surface temperatures, Atmospheric temperatures, Climatic change, pottery, stone arrowheads, Jomon people

 

# Human adaptations to alpine landscape during 30-19 ka: exploitation of obsidian sources in the Last Glacial Maximum

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The paper focused on the human-environment interaction between climatic impacts of the Last Glacial Maximum (LGM) and obsidian exploitation of the Upper Palaeolithic (UP) hunter-gatherers. The correlations were examined using three datasets. First, changes in obsidian use in the Chubu-Kanto region during ca. 38-19 ka were reconstructed by using ca. 80,000 obsidian sourcing data assigned to cultural horizons in the UP chronology. Second, how changed site distribution patterns during the UP in the obsidian source area of Central Highlands 1200-1400 m were described. Finally, chronological control was established by means of calibrated radiocarbon dates between palaeoenvironmental record for the past 30,000 years obtained from the Hiroppara bog situated 1400 m in the Central highlands (Yoshida et al., 2016) and the archaeological record mentioned above. To compare these datasets, four periods divided into before 30 ka, 30-25 ka, 25-20 ka, and 20-19 ka were adopted.
Results are as follows. (1) The use of Central Highlands obsidian in the Chubu-Kanto region before 30 ka shows the highest percentage, while the use frequency suddenly declines during the early LGM 30-25 ka. The pollen record (pollen accumulation rate for tree: PARt) during 30-25 ka clearly indicates that the tree line retreated below 1400 m and the alpine landscape prevailed in the source area. No sites are distributed in the area, indicating human activities for stone tool production were very sparse. (2) Pollen record in the LGM cold phase 25-20 ka shows that the tree line remains descended below 1400 m and the climatic condition in the alpine landscape gradually deteriorated from 25 ka to 20 ka. A number of large-sized lithic industries, however, are distributed in the alpine landscape, indicating vitalization of obsidian procurement and stone tool production in the area. (3) The tree line gradually ascended during 20-19 ka and reached above 1400 m by 17 ka, reflecting climatic amelioration in the deglaciation period. In spite of warming, the number of sites in the alpine landscape decreased and the use frequency of the Central Highlands obsidian in the Chubu-Kanto region also declined. In contrast, the use of obsidian from the Kozu Island transported by seafaring suddenly increased and competed with that of the Central Highlands obsidian. Additionally, the distribution of the Central Highlands obsidian clearly prevailed in the northern half of the Chubu-Kanto region, while that of the Kozu Island obsidian heavily biased in the southern half of the region.
Human adaptations during 30-19 ka to the alpine landscape in the source area of Central Highlands show a complex history. In the early LGM 30-25 ka, the climate deterioration and the decrease in frequency of access to the Central Highlands show a strong correlation. In this period, the exploitation of the Hakone and the Izu-Amagi source areas where the sources were located in lower altitudes was preferred. The hunter-gatherer groups during 25-20 ka, however, actively exploited the alpine landscape where the cold and dry climate still dominated. Cultural adaptations such as skills for occupation in the alpine landscape were likely improved. In 20-19 ka, the sudden increase in the use of Kozu Island obsidian strongly implies that the emergence of the northern regional group mainly exploiting the Central Highlands for obsidian procurement and the southern regional group preferred to use the Kozu Island obsidian. Accordingly, the development of forest landscape in the Central Highlands after 20 ka was not likely related to the obsidian use dynamics. Instead, the societal change impacted on human activities for the natural resource exploitation.

Yoshida, A., Kudo, Y., Shimada, K., Hashizume, J. and Ono, A. 2016 Impact of landscape changes on

 

obsidian exploitation since the Palaeolithic in the central highland of Japan. Vegetation History and Archaeobotany, 25: 45-55.

Keywords: obsidian exploitation, Upper Palaeolithic, human-environment interaction

 

# Vertical changes of tree-line and site distribution: a case of early Mesolithic in northern Tyrol, Austria

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The presentation focuses on correlation between 1) palaeoenvironmental changes expressed on ice sheet regression and site distribution, and 2) vertical changes of tree-line and site distribution in the early Mesolithic in northern Tyrol in Austria. Ullafelsen open air site (ca. 112,000 - 10,650 cal yrBP ) is located in high mountain of Fotcher valley, Stubai Alps. Excavations have revealed that at least two different cultural traditions such as Beuronian from southern Germany and Sauveterrian from northern Italy in exactly co-existed archaeological contexts. Many lithic raw materials have also identified i.e.; flint from southern Alps, rock crystal from central Alps, radiolarite form northern limestone Alps, and hornstone from Franconian Alp (Bavaria). These materials indicated high mobility of early Mesolithic people, and they had much more wide range exchange network than the later phase of Magdalenian groups in the upper stream area of Danube river. This means the early Mesolithic people had extended their activity to the wide area that had been performed after retreatment of the ice sheet from the right bank of Danube river to the northern Tyrol. Vertical rise of climate-induced tree-line and site location have relatively strong causal relationship, and this pulled up the location of Mesolithic sites, because of their hunting strategies for Alpine Ibex (*Capra ibex*) etc., that they are favorable to inhabit at tree-line zone. These phenomena indicate a dynamic correlation between natural resource environment and human adaptations.

Keywords: northern Tyrol , Ullafelsen site, early Mesolithic, tree-line, site location

 

# Geologic attractiveness of the Zagros Mountains for early humans

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The Zagros Mountains of Iran, which culminate in Mt. Zard (4548 m), formed along the convergent boundary between the colliding Arabia and Eurasia plates during late Miocene to early Pliocene time. The range consists almost entirely of limestone. Recently, the Zagros Mountains have yielded key evidence of the expansion from Africa of Homo sapiens, which originated in East Africa 200,000 to 100,000 years ago. There are two main routes from Africa to Eurasia, a northern route from the Sinai Peninsula to the Levant and a southern route around the Arabian Peninsula. Because recent research in Iran has documented Paleolithic remains from before 50,000 years ago at Arsenjan, northeast of Shiraz, the southern Zagros Mountains have received attention for their role in the southern route of early human migration. Early humans who followed this route onto the Eurasian continent would have confronted the Zagros Mountains immediately. This situation, however, was so fortunate for them that the Zagros Mountains became a starting point for the spread of humans to the rest of the world. Raw material for stone tools was easily available in the form of radiolarite (chert), and the abundant limestone caves served as ready dwellings near the radiolarite outcrops. This limestone-radiolarite association that characterizes the Zagros Mountains provided superb conditions for these ancient people. This association also occurs elsewhere in Western Asia and in the Mediterranean region. The objective of this study was to determine what geological factors in the Zagros Mountains brought benefits to the first humans coming out of Africa. During the Jurassic, the continents of Laurasia and Gondwana were separated by the shallow Neotethys Ocean. Present-day western Asia was located at the innermost part of the Neotethys near the paleo-equator at a favorable location for upwelling currents, resulting in high faunal productivity. Thus, an extensive carbonate platform developed on the Arabian continental margin. After the Arabia plate separated from the Africa plate and collided with the Eurasia plate, the limestone-radiolarite association was folded and uplifted to form the Zagros Mountains. Here came to be a land replete with limestone caves and widespread radiolarite that welcomed ancient Homo sapiens.

Keywords: Zagros Mountains, Stone tool, radiolarite

 

# A natural disaster can be a factor of landscape change? –with special reference to Lake Kitagata in Awara, Fukui, Japan

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The change of landscape might be caused by the combination of climate change, human activities, natural disasters, etc. Many human activities transformed the landscape during historical period. Lake Kitagata is located in Japan Sea coastal area, central Japan, and is surrounded by sand hill, coastal terrace and flat plain. Many archaeological sites including a salt production site are distributed around the areas. In the flat plain, major land transformation to agriculture is recorded in the early 12$^{th}$ century AD. Considering the impact of tsunami in Tohoku area, natural disasters have also influenced the surrounding vegetation and landscape. Several tsunamis were recorded in Japan Sea coastal area during historical period, and the Tensho Tsunami which might influenced the area occurred in AD1586. A crop failures and consequent peasant uprising due to salt damege and typhoon was also recorded in AD1712. However, the damages from them are unknown. Five sediment cores were recovered from Lake Kitagata.We sub-samplesd for pollen analysis from three cores, and analyzed the samples, in order to reveal the landscape change around Lake Kitagata.
Based on the pollen analysis, the land including plain area were covered with dense forests of evergreen oak and *Castanopsis*. Salt making caused a deforestation in plain area and around the 12$^{th}$ century when land transformation to agriculture occurred, paddy fields seems to be developed in the deforested area for salt making around Lake Kitagata. Buckwheat has been cultivated intensively since the late 13$^{th}$ century AD when the Little Ice Age started in Japan. The development of pine forests dates back to around the 17$^{th}$ Century AD. Before this, the area was spotted with few trees especially in plains and ferns grew thickly in the river mouth of Daishoji River. It seems that the surrounding vegetations have transformed to Japanese cedar and evergreen forests recently.
During this succession, natural disasters seemed to change the vegetation. One may be in response to Tensho Tsunami in 1586. Almost all pollen taxa decreased but *Pinus* subgen. *Diploxylon*. In this time, salt damage might not happen since Chenopodiaceae which has salt tolerance did not increase. Another one was observed in the late 17$^{th}$ century AD. It seems that the vegetation was damaged by salt. Large amount of Chenopodiaceae pollen was observed in this period. A peasant uprising which was caused by crop failures due to salt damege and typhoon was recorded in AD1712. However, the vegetation was soon recovered. Although an impact from disasters on vegetation was observed, it did not last long. Human activities and climate seems to be much bigger factors.

Keywords: pollen analysis, vegetation, disaster

 

# Relation between with distribution of liquefaction-fluidization phenomena at the 2011 off the Pacific coast of Tohoku Earthquake and distribution of the Holocene strata

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Liquefaction-fluidization phenomena distributed widely on the reclaimed land around northern Tokyo bay at the 2011 off the Pacific coast of Tohoku Earthquake. Sand-volcanoes by liquefaction-fluidization distributed on belts with 500m wideth in the reclaimed land from Ichikawa city to Chiba city. Continuous boring cores were taken and shear wave velocities were measured on Gyotoku high school in Mamagawa belt and Funabashi-Minato junior high school in Ebigawa belt. Sand-volcanoes distribute almost on paleo-valley at the last ice age around the survey sites.
Strong waves were simulated by SHAKE method on strong motion data in Shimosa Group at reclaimed land in Chiba city at the survey sites in the paleo-valley and out of the paleo-valley, neighbor sites.
On Mamagawa belt, JMA intensity 6- in the paleo-valley and 5+ out the paleo-valley were calculated. On Ebigawa belt, JMA intensity 5+ in the paleo-valley and 5- out the paleo-valley were calculated.

Keywords: the 2011 off the Pacific coast of Tohoku Earthquake, liquefaction-fluidization, Tokyo bay reclaimed land, Man-made strata, Holocene strata

 