

The Alluvium and its basal topography between the Arakawa-Menuma Lowland and the Nakagawa-Watarase Lowland, Japan

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We first compare developments of the latest Pleistocene-Holocene incised valley fill (the Alluvium) and its basal topography in the Arakawa-Menuma Lowland and the Nakagawa-Watarase Lowland, the Central Kanto Plain. Then, we discuss how global sea-level change, local tectonics, and fluvial sediment supply influence developments of them and degree of Holocene transgression.

In the study area, the basal topography beneath the Alluvium is classified into three types; buried incised valleys, buried fluvial terrace surfaces, and buried abrasion platforms. The incised valleys and buried terrace surfaces were formed under the influence of sea-level drop in the Last Glacial. Their longitudinal profiles and slopes in the Arakawa-Menuma Lowland are roughly similar to those in the Nakagawa-Watarase Lowland. By contrast, deformation of incised valley near the concealed Fukaya fault is evident in the border region between the Arakawa Lowland and the Menuma Lowland (Ishihara *et al.*, 2011a), while the longitudinal profile of the incised valley in the Nakagawa-Watarase Lowland continues smoothly. Buried terrace surfaces develop clearly in the Arakawa Lowland, hanging wall zone of the Fukaya fault, whereas they are not clear in the Menuma Lowland, footwall zone of the Fukaya fault. In the Nakagawa-Watarase Lowland, where broadly located footwall side of the Fukaya fault and the center of subsidence persisting throughout the Quaternary (Kaizuka, *et al.*, 1977), buried terrace surfaces distributed fragmently. This is suggested that local tectonics, as well as sea-level change, have influenced the formation of basal topography.

The buried abrasion platforms were formed during the Holocene transgression (Kaizuka *et al.*, 1977). Their distribution in the Nakagawa-Watarase Lowland is extensive (Matsuda, 1974) because inner bay environment continued longer than the Arakawa-Menuma Lowland and surrounding uplands consist of weakly consolidated Pleistocene sediments. The Musashino Upland, western side of the Arakawa-Menuma Lowland, composes gravels indicated that the upland was resistant to abrasive action. In addition, several tributaries of the Arakawa River which have flowed between the Musashino Upland may have prevented expansion of inner bay along the Musashino Upland.

Developments of the Alluviums in the Arakawa-Menuma Lowland are totally similar to those in the Nakagawa-Watarase Lowland. In both lowlands, it is indicated that Holocene transgression influence fluvial sedimentary succession in inland where no marine sediment is deposited. By contrast, totally grain size of the Alluvium tends to be larger in the Arakawa-Menuma Lowland than in the Nakagawa-Watarase Lowland. Additionally, onset of regression in the Arakawa-Menuma Lowland was in ca. 8 ka (Ishihara *et al.*, 2011b), 1 ka earlier than in the Nakagawa-Watarase Lowland (6.5-7 ka). These differences in above lowlands are attributed to differences of fluvial sediment supply. Especially, it is indicated that large tributaries influence the sediment supply.

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Keywords: Alluvium, Basal topography, Sea-level change, Marine transgression, Fukaya fault, Fluvial sediment supply

Subsurface structure around Wakayama plain

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In Wakayama Plain, Pliocene to Quaternary sediment and terrace sediment are deposited. These are covered with Holocene deposit at the lower plain and around Osaka bay area. There are less information of surface structure. The Geo-database Information Committee of Kansai Area has developed a geotechnical database for the Kansai area. The geo-database was developed with a focus on the urban area because of its social and economic importance. Data of more than 40,000 boreholes were collected and digitized (Fig.3). Essentially, the data consist of information on soil classification, N values, and some data from soil tests. However, sedimentary facies and N-values (one of the indices that indicate soil property from the viewpoint of soil engineering) are regarded as important indices of subdivision and continuity of a formation. Since the geo-database includes results of soil investigation such as physical properties and mechanical properties of soil, it is easy to compare the data of this geo-database with data of the sedimental environment and soil properties.

In this committee, we study about Wakayama plain and correct the borehole data for two years. All cores boring were carried out at the Wakagawa area. The sedimentary environment indicates two marine layers.

Keywords: Wakayama Plain, borehole, database, sedimentary environment, alluvium

Subsurface geologic structure of the Fukuoka Plain near the Kego Fault based on borehole database

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The Kego Fault is a 50km-long north-west trending left-lateral slip active fault in north Kyushu, Japan. The southeast part is traced in the Fukuoka plain. We formed the shallow-level subsurface geologic model of the Fukuoka Pain based on the borehole database in order to reveal subsidence of the plain and the sedimentation affected by active faulting of the Kego Fault.

Keywords: borehole data, subsurface geologic model, Kego Fault, Fukuoka Plain, Quaternary

Formation of subsurface layer and examination of the generating depth of liquefaction at the Hinode area, Itako city

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Serious Liquefaction phenomena happened on Hinode, Itako, Ibaraki Pref., middle to downstream region of the Tone River, at the 2011 off the Pacific coast of Tohoku Earthquake. Those damaged area were on reclaimed land by dredge. The stratum of the damaged area consists of the sediment of lowlands and the dredge sandy sediment as a result of the drilling survey. Judging from the facies of sediment and grain size composition, liquefaction is presumed to have occurred in the lower part of dredge sandy sediment.

Keywords: The 2011 off the Pacific coast of Tohoku Earthquake, Liquefaction, Dredging sand layer, Itako

Liquefied layers and their deformation structure identified in all core samples.

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Sedimentological investigations were carried out to all core samples acquired from the sites where liquefaction widely took place or ground failure occurred caused by the 2011 East Japan Earthquake. According to the usual core analysis procedure, all cores were first split into two halves along the core axis and photographed. The surface of one half of core was delaminated using polyurethane resin. Magnetic susceptibility was measured for the standard 7-cm³ plastic cubes which were pressed into and retrieved from a half core at 2.5-cm or 5-cm intervals. A number of 10-mm thick, 60-mm wide, and 25-cm long plate samples were also removed from the cores for taking the soft X-ray photographs. Grain size distributions were determined by combining traditional sieving data with those obtained using a laser diffraction particle size analyzer.

We first conducted above core analysis for a total of 7 boring cores sampled at Kokai River, Ibaraki Prefecture, where levee were partly failure by the earthquake. Sand dykes were caught in cores, and also liquefied layers were identified having characteristic deformation structure. Clay blocks were frequently included in the liquefied layers. The core analysis highlighted the usefulness of it for the investigation of liquefaction and also showed the potential false estimation of liquefaction by means of conventional FL method based on non-core drilling data and N-values of Standard Penetration Testing.

Keywords: East Japan Earthquake, liquefaction, all core boring, deformed structure

Tidal flood delta and buried oyster reef in Akkeshi -Bay and Lake eastern Hokkaido, revealed by sonic survey

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The coastal area of Kushiro-Nemuro region, eastern Hokkaido is tectonically controlled by sudden uplift when giant earthquakes occurred at intervals of a few hundreds years and subsequent long and slow prevailed subsidence during late Holocene. Therefore, an active barrier system generally characterizing a transgressive stage and system is developed around the Recent Akkeshi Bay - Akkeshi Lake area (e.g. Shigeno others, 2011). Akkeshi Bay located between Kushiro City and Nemuro City, approximately 9km wide and 30m deep at maximum is connected with Akkeshi Lake by a tidal inlet about 500m wide and 10m deep. Akkeshi lake is a lagoon with the mean depth of about 2m, and a wide flood tidal delta is distributed in the western part of the lake. Until thirty years ago, modern oyster reefs had been developed in the wide area of tidal flat on the flood tidal delta, though already all extinct.

We carried out the single-channel sonic survey by using Sono-probe for the purpose of elucidating the inner structure of the flood and ebb tidal deltas and the distribution of modern oyster reefs around the Akkeshi Bay - Akkeshi Lake area. Inside of the lake, because of the shallowness and gregarious eelgrass, sonic survey lines were restricted to the east-westward trending fairways. In contrast, we arranged the most of sonic survey lines in N-S direction across tidal inlet within the Akkeshi Bay area except for the lines located along the east-westward sand-spit.

As a result of sonic survey, some distinct reflections gently dipping outside in coarse- grained deposits were recognized on sonic profiles across the tidal inlet. It shows the ebb tidal delta formed by ebb tidal currents. Furthermore, several strong reflections were observed on the profile along the sand-spit. These reflections are nearly consistent with the borehole lithostratigraphic data from coastal lowland areas.

In the flood tidal delta along the lake mouth area, we found some upheaval topography (mound-like structure) traced with strong reflections, even though the inner structure of the flood tidal delta is not clearly observed. The depth of these surfaces ranges 2 - 4m, and it is thought to be submerged oyster reefs judging from their shape and reflection patterns.

Keywords: tidal flood delta, buried oyster reef, Akkeshi Bay and Lake, sonic survey, late Holocene, Hokkaido

Boring survey across the active structure along Yufutsu coast

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We will give presentation on the result of boring surveys along the Yufutsu coast across the possible active fault, which has been expected from the linear elevation gap in bathymetry.

Keywords: Yufutsu, Tomakomai, bring survey, latest Pleistocene to Holocene incised valley fill, active structure, coastal area

Reconstruction of change of salinity condition since the middle Holocene in the Lake Jusanko, northeastern Japan

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The Lake Jusanko is a lagoon which is located in northern limit of Honshu Island in Japan. This lake is one of the most famous lake for producing *Corbicula japonica* in East Asia. The lake has an area of 17 km², and 2 meters in maximum depth. The purpose of this study is to reconstruct the salinity condition changes in the Lake Jusanko based on the analyses of diatom, facies, and AMS¹⁴C dating.

The result of this study indicates that the study area submerged related to postglacial transgression in the early Holocene. After the transgression, this area changed the sea. Consequently the lake had been buried by delta deposit transported by the River Iwaki and the River Yamada. Based on diatom analysis, the Lake Jusanko had been freshwater condition during 5700-1000 cal BP, and lagoonal brackish lake has been formed since 1000 cal BP in central part of the Jusanko. In the upper part of the Lake Jusanko (near the river mouth of Iwaki and Yamada rivers), we can confirm that the change of salinity condition was similar to the change in the central part. However, the period of the environmental change from brackish to fresh water has started earlier compare to central part of the lake.

Keywords: Holocene, the Lake Jusanko, salinity condition

Combined geological and geophysical investigations of a heavily liquefied site: A case at Makuhari-Kaihin Park.

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Combined geological and geophysical investigations were conducted at Makuhari-Kaihin Park where significant sand boiling from fissures was observed accompanied with liquefaction caused by the 2011 East Japan Earthquake. The park was reclaimed just after the 1987 East off Chiba Prefecture Earthquake using dredged fine sand and covered by surface soils up to 5 m in thickness. Because the boiling sand is characterized by fine sand including large amount of shell fragments, it was presumed to be originated from the dredged sand. However near-surface geology was still unknown and there were few available drill data around the park. To clarify the near-surface structure, we conducted the following surveys.

SPT boring (1 hole to 35 m) and Suspension PS logging,

All-core Boring (4 holes to 20 m),

CPT and SCPT (7 points to 15 m),

Surface sampling using Handy Geoslicer (9 points to max. 2.4 m),

Surface sampling using Daiki core sampler (4 holes to max. 4.3 m),

Dynamic cone penetrometer test (6 point up to 6.3 m),

and Surface wave survey and high-resolution SH seismic reflection survey
(120 m, 2 lines).

As a result, a low S-wave velocity layer was identified at the dredged sand horizon about 3 to 5 m in depths. The combined survey showed that it is capable to delineate liquefied layers as anomaly zones in geophysical profiles.

This field survey was conducted as an urgent liquefaction research supported by Kanto Regional Development Bureau, MLIT.

Keywords: East Japan Earthquake, liquefaction, all core boring, geophysical survey

MIS5e marine terrace in southern Inbanuma, Japan

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In Shimousa upland, the Kioroshi formation formed MIS5e marine terrace (Sugihara 1970). Paleo Tokyo Bay opened for Pacific Ocean during full last interglacial period, so that the Kioroshi upper member consists of sands in shallow sea. During late last interglacial period, Shimousa upland developed barrier islands, and the inside of these consists of muds member during regression period (Okazaki et al. 1992). But, stratigraphy of this muds member has not been enough.

In order to reveal MIS5e marine terrace in southern Inbanuma, we basically analyzed, stratigraphy, tephra and sedimentary environment.

The results are as follows;

In southern Inbanuma, the Kioroshi sands member is absent, and the Kioroshi upper muds member overlies the Kiyokawa formation. The Kioroshi upper muds member has a range of this area.

According to the mineral refractive index and all rock chemical composition, the Hk-KmP1 tephra includes the Kioroshi upper muds member.

Sedimentary environment of the Kioroshi upper muds member has been river mouth and inner bay, by mud content, total sulfur, and shell fossil.

Considering these results, the marine terrace over the Kioroshi upper muds member was formed by sea level change during regression period from MIS5e to MIS5d.

Keywords: Last Interglacial period, Shimousa upland, Sea level change, Tephrochronology, Total sulfur

Stratigraphy of the 1505m long hot spring well in the central Kanto Plain, Japan

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We investigated calcareous nannofossil and diatom biostratigraphies and tephrostratigraphy of the 1505m long hot spring well at Kazo city (former Otone town) in the central Kanto Plain, Japan. The lower part of the well is correlative with the Early Miocene to the Early Pliocene, and the upper part of the well is correlative with the Pleistocene. Stratigraphic correlation with subsurface and terrestrial Neogene and Quaternary deposits in the Kanto Plain is discussed.

Keywords: central Kanto Plain, biostratigraphy, calcareous nannofossils, diatoms, Quaternary, Neogene

Chronology of marine terraces of the northern part of the Noto Peninsula, central Japan

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We investigate the distribution pattern and chronology of marine terrace in the northwest wedge of the Okunoto hill, the northern part of the Noto Peninsula, central Japan, based on the topography of the 1m-digital elevation model (1m-DEM) measured by airborne LiDAR and the tephrochronology of widespread tephra on marine terraces. The topography shows the horizontal and vertical distributions of each marine terrace and the heights of their former shorelines. Five widespread tephra, AT, Aso-4, K-Tz, SK, and Kkt, are found from the terrace deposits and covered soils with coloring of 2.5-5YR in the Munsell system color classification.

The topographic investigation and tephrochronology enable us to distinguish the middle marine terrace corresponding to sea level of 125ka (Marine Isotope Stage 5e) from the other marine terraces. The middle marine terrace is characterized by a broader distribution than the other marine terraces. The detection of K-Tz tephra (95ka) from the middle to lower part of covered soils distinguishes the middle marine terrace from the older and younger terraces. In the older terraces, Kkt tephra (330-340ka) is found from the terrace deposit underlying soils with mottling coloring of 2.5YR. In younger terraces corresponding to Marine Isotope Stage 5c, SK tephra (110-115ka) is found from the terrace deposit.

We trace the former shoreline of the middle marine terrace corresponding to Marine Isotope Stage 5e, and measure the altitude of the former shoreline along the northern coast of the Noto Peninsula. The altitude distribution shows a relative upheaval in the two separated areas. In the west part, the altitude became high from the Wajima area to the Machino area. In the east part, the altitude became high from the Uji area placed the east end of the Noto Peninsula to the Orito area. As the result, we suggest that each area has been formed by the cumulative crustal deformation due to offshore active faults, the Wajima-oki and Suzu-oki segments.

Keywords: the Noto Peninsula, tephra, marine terraces, Airborne LiDAR, SK tephra, Kkt tephra

Discovery and the Causes of re-weaked Middle Pleistocene deposits

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The northern coast of Ariake Sea forms part of the Tsukushi Plain in Kyushu, West Japan. The area is underlain by thick Quaternary deposits in which the surface layers consist of weak strata. Bearing piers for structures such as bridges need to be founded on strata that are sufficiently strong to support the anticipated loads. This is commonly determined in Japan by means of the Standard Penetration Test (SPT) in which a 63.5 kg hammer falls through a fixed distance of 76 cm to drive a diameter sample tube into the sediment. The number of blows (the N-value) taken to drive the drive the sample tube 30 cm into the sediment provides an indication of density and hardness of the sediment that can be used to indicate its load bearing capability. SPT N-values greater than 30 are usually necessary for load-bearing layers in the Tsukushi Plain. In general, the density and hardness of sediments increases with depth after deposition due to compaction and, in some cases, cementation (diagenesis). For this reason, older formations are commonly more dense and stronger than younger formations. It has generally been thought that in the Tsukushi Plain area the Aso-4 pyroclastic flow deposits (80-90 ka) were strong enough to support heavy buildings. However, weak Middle Pleistocene Formations (N-value < 10), referred to as the Shagarami Formation in this account, have been found in recent years beneath the Aso-4 deposits. The low bearing capacity of the Shagarami Formation causes engineering problems.

The two main reasons for the low N-values are considered here. First the possibility is that the stratum is too young to have been sufficiently altered by diagenesis. Second, that it is a calcareous marine deposit in which the carbonate grains have been dissolved by groundwater cultivation for agricultural purposes and that this produced loose silt. Few borehole cores have been taken from below Aso-4 in this region, but the availability of cores in the Shagarami Formation from a site near the mouth of Rokkaku River made it possible to examine sediments that were known to have unusually low N-values. The aim of the present study was determine the age and depositional environments of the formation and their relationship to the low N-values.

The boreholes proved the presence of a previously unknown tephra in the Shagarami Formation (the Shagarami tephra) which gave a zircon FT age of 0.33 Ma. The refractive index of volcanic glass from the tephra together with its age and the petrological feature such as mineral combination suggests correlation with the Kakutou tephra (Kkt, 0.33-0.34 Ma). The Shagarami Formation contains diatoms, shell fossils and sedimentary structures indicative of deposition in marine environments. No carbonate shells apart from oyster shells were preserved in the cores. The formation can be divided into two sequence units that were probably deposited at periods of high stand in Marine Isotope Stage 9 and 11.

In conclusion, the cause of the low N-values in the Shagarami Formation is that the formation is too young to have become sufficiently compacted or lithified. Underground weathering or leaching might also be a contributing factor.

Keywords: Tsukushi Plain, lowland, Fission Track age, Middle Pleistocene, underground weathering, leaching

3D-geological model of alluvial formation under Miyazaki Plain using borehole database

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Around 50 m thick "Chuseki-so," which is being deposited since the Last Glacial Maximum to the present, is distributed under the most downstream part of the Oyodo-gawa River in the southern part of the Miyazaki Plain. The deposits of Chuseki-so in this area, which fills the incised valley of the Oyodo-gawa River, are composed of fluvial, shallow marine and marsh deposits containing pyroclastics of the west Japan volcanic belt from the upstream part of the river. In the plain, Holocene terraces of four levels, which are accompanied by the paleo-river channels and natural levees on their surfaces, are well developed. The highest terrace, which was formed by an uplift during the Holocene, is composed of marine deposits of the shorelines of the Jomon transgression period at about 8 m from the present sea-level.

An explanation of the detailed distribution of Chuseki-so in such complicated settings is of considerable importance in applied geology, such as for determining the distribution of soft ground, as well as for understanding the depositional process of Chuseki-so. In general, because deposits of Chuseki-so have a good continuity in the horizontal direction, three-dimensional geological and geotechnical grid models of the Kanto Plain have been developed. We applied a modified method of horizontal gridding for the Chuseki-so of the Miyazaki Plain using digitized borehole logs, and developed a three-dimensional geological and geotechnical grid model.

Keywords: Miyazaki Plain, 3D model, Chuseki-so, beach ridge, soft ground, uplifted area

Floodplain formation and reclamation of the Song Hong (Red River) Delta plain, northern Vietnam

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The Song Hong (Red River) delta, northern Vietnam, is characterized by huge natural levees in an area of the delta plain known as the West Floodplain where fluvial sedimentation predominates. The natural levees along the Day River, a major distributary of the Song Hong, are larger than those of the main course of the Song Hong. The Day River levees are 3?8 km wide and rise 3?5 m above the adjacent backswamps and have played an important role in human settlements since the late Metal age. In this presentation, we discuss the Holocene evolution of the Day River levees to determine their relationship to Holocene sea-level change, delta progradation, and the distribution of archaeological sites on the delta plain. Also, we present the land reclamation and disaster mitigation history in relation with geomorphological features.

Keywords: Song Hong (Red River), floodplain, reclamation