The embodiment of the consecutive penetration tests in the Liquefaction-Fluidization place

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2011 occurred on March 11, 2011 Tohoku-Pacific Ocean earthquake and liquefaction and liquidity phenomenon of the formation by the largest aftershock (less liquid fluidization), Jinami phenomenon has occurred. Liquid flow of the embankment, man-made strata was observed also in the inland as well as coastal areas by this earthquake. Depending on the structure, because it was observed in many cases it can be used again if the lift or the subsidence part or return horizontally, this study area is located in the man-made strata distribution area that has received the liquid fluidization damage building construction jack-up by the steel pipe pile construction as the restoration method of the object has been selected. While the support layer depth and N values measured for thickness confirmation were required upon installation rather than the usual standard penetration test to implement the N value measured every 1m, continuous penetration test to implement the N value measured every 50cm it was adopted. This is a distribution in the depth direction as viewed from the N value of liquid fluidized layer, by performing as much as possible detailed observation of the sample taken without creating a non-core section, an intermediate survey and the positioning of the standard penetration test and all core boring, as long as is brought close to the no attempt, is considered rare example unparalleled is in that could also be confirmed up to now as the investigation of the time less than after the disaster in one month. Survey method is a continuous penetration test of 10-15m was carried out in 1 point (a total of 6 points) of each building vicinity, previously implemented only up to 20m 1 point corresponding to the on-site center, this each sample detailed sample observation carried out close-up on the spot of the point was carried out in the indoor (on Workstation). Results of the investigation, geological structure based on the 20m hole geological observations were classified as follows. 1st layer (N value of 4/32-9) crushed stone, concrete silt mingled with fine sand at a layer thickness of 0.40-1.25m - estimated non-liquid fluidized layer of fine sand mingled with silt.2nd layer is sand layer (N value of 0/20-12) many very fine grain sand water at a layer thickness of 2.20-4.95m - N value of 3 or less in the middle part and in particular the entire base portion in a liquid fluidized layer of fine-grained sand (minimum 0/20) the admit.3rd layer is clay layer (N value 1-5) estimated fluid fluidized layer of fine-grained sand mingled with silt of the lens-shaped distribution at a layer thickness of 0.85m.4th layer is foreshore after the beach sediment layer (N value of 4/32-50 or more) non-liquid fluidized layer of fine-grained sand to the development of the black beam at a layer thickness of 1.90-7.40m.5th layer is nearshore sediment layer (N value 14-50 or more) the confirmation layer thickness 13.60m bulk-free layer management in the array or silt contamination of irregular sand particles (biological disturbance) and sand pipes and mud pipes and fine sand - silt mingled with fine-grained non-liquid fluidized layer of sand shells fine piece is mixed, of 5, which is a division. As advantages of the present survey methods, can also be applied in the building bowling because it is a rule, a:N value measurement, there is a possibility that can discover the b:stratum fluidization trace (the discovery of re-liquefaction danger), on the other hand as the points to keep in mind, is a:hydrous very many samples need basket with shoe for fall prevention for easy to fall, focus on a flat break-all sand particles as much as possible the sample surface in the close-up of sample, sure unit investigation capable engineers in charge to things like.

Keywords: Reliquefaction-Fluidization place, Advantage of continuous intrusive examination, Fault of standard penetration test

Litho-stratigraphy on reclaimed land in northern Tokyo bay and liquefaction-fluidization horizon at the 2011 off the Pacific coast of Tohoku Earthquake: from the geological survey by continuous boring cores

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Liquefaction-fluidization phenomena caused widely on reclaimed land along northern Tokyo bay at The 2011 off the Pacific coast of Tohoku Earthquake. Stratigraphy of this site is composed of the middle- upper Pleistocene Shimousa group, the Holocene formation and Man-made formation in ascending over. Shimousa group, under 41.7m depth, consists of mainly very dence sand bed with thin silt bed and tephra beds. Holocene formation, from 41.7m depth to 5.53m depth, consists of bioturbated soft silt beds, bioturbated very fine sand beds, coarse silt beds and fine –medium sand beds with pebble from Kanto Loam formation. Man-made formation, over 5.53m depth, consists of clean fine - medium sand beds, shelly coarse - very coarse sand bed, clayey fine silt bed and coarse silt bed.
Primary sedimentary structure, lamination deformed or lost partially on sand bed in 2.65-3.75 and 5.00-5.53m depth. It is presumed that these horizons were liquefied and fluidized on the 2011 off the Pacific coast of Tohoku Earthquake.

Keywords: Liquefaction-fluidization, the 2011 off the Pacific coast of Tohoku Earthquake, continuous boring core, Man-made strata, reclaimed land

Luminescence age of Holocene sand dunes and alluvial lowlands at costal area in Tonbetsu plain, northern Hokkaido, Japan

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In Tonbetsu plain, northern Hokkaido, a series of fluvial terraces and sand dunes are distributed whose detailed chronology is unknown. Reconstructing the Holocene geological evolution in Tonbetsu plain is very important, due to the existence of many prehistoric sites are found on the sand dunes and their around area and also due to a rare ecosystem around the sand dunes and alluvial lowland (Fujita, 2014; Hamatonbetsu Town Education Board, 2014). To establish the chronology of young coastal sediments and fluvial terraces in Tonbetsu plain we used a combination of different luminescence dating methods including OSL dating of quartz and post-IR IRSL (pIRIR; Thomsen et al., 2008) dating of feldspar using both fine silt and sand sized grains. The OSL signal of the coarse grain quartz samples from the dune sand is dominated by slow components, suggesting that the sand sized quartz is not a suitable dosimeter (Thiel et al., 2015). Therefore we applied pIRIR dating of K-feldspar (pIR_{150}; Reimann and Tsukamoto, 2012) to the sand samples.
The results indicate that, 1) pIR_{150} dating is an effective tool to date the Holocene sand sized sediments in Tonbetsu plain, 2) it is possible that the sources of quartz are different depending on grain size or geologic period, because the OSL ages of fine grain quartz are reliable in the study area (Kondo et al., 2007), 3) the sand dunes have been formed from the inland side sequentially after ca. 5.7 ka following maximum of the Holocene transgression in central Tonbetsu plain, 4) in southeastern Tonbetsu plain, the sand dune formation has been continued until the late Holocene, with alterations of stable (inactive) stages and destruction events by storm surge, and 5) in northwestern Tonbetsu plain, the sand dune formation stopped by the late Holocene, or younger sand dunes close to the coast were eroded completely by waves.
We will also show the luminescence dating results of the alluvial lowland and lower fluvial terraces in the study area.
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Keywords: sand dune, alluvial lowland, pIRIR / OSL dating, Tonbetsu plain, Holocene

Identification of Nantaisan Shichihon-sakura/Imaichi tephra (Nt-S/I) in the sediment core MD01-2421 collected off the Kashima coast, Japan

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IMAGES core MD01-2421 (45.83 m) from the northwest Pacific Ocean off central Japan yielded twenty-three tephra beds. Descriptions of the twenty-three tephra beds have been made using the major-element composition of glass shards and refractive indices (RI) of glass shards and phenocrysts. As a result, at least seven on-land maker tephra layers have been identified. Two tephras, AT and Aso-4 come from Kyushu: Aira and Aso calderas. Four tephras come from central Honshu: Ag-KP from Mt. Akagi, Hk-TP from Hakone caldera, On-Pm1 from Mt. Ontake and Tt-D from Mt. Tateyama. One tephra, TG as the lowest layer of all, comes from northeast Honshu and are correlated around the coastline of southern Fukushima. Later, we have been studying the source volcanoes of remaining sixteen tephra beds. In this study, we report the new information on the source of Tephra 1 obtained recently.

Tephra 1 (925.6-933.1 cm) are characterized by coarse and bad selected volcanic sands consisting of white to pale brown pumice and black scoria which grain size is limited to 3 mm. Its thickness is 7.5 cm disturbed in liquid mud. The deposited age of this tephra is estimated at 17.7±1.38 ka based on the oxygen isotopic stratigraphy of the benthic foraminifera and the calendar ages of foraminiferal fossils calculated from the accelerator mass spectrometry (AMS) ^{14}C ages. Pumices are cross-foaming and include many microlites. Refractive index of volcanic glass shards exhibits bimodal as 1.498-1.503 and 503-1.509. Aoki et al. (2008) pointed out that 63-125 μm size particles consist of weathering minerals besides volcanic materials and geochemistry of 125-250 μm size volcanic glass shards indicated heterogeneity, hence there is a strong possibility that particles limited to 250 μm in this tephra bed included contaminant besides essential volcanic materials. To address this problem, we hand-picked 2-3mm size pumice grains, and crushed them for EPMA analysis. Consequently, it becomes clear that geochemistry of pumices are rhyolitic and rich in alkaline component elements relatively (SiO_2; 78.3wt%,NaO_2; 3.18wt%, K_2O; 3.79wt%). Next, geochemistry of Nantaisan Shichihon-sakura/Imaichi tephra (Nt-S/I), in some tephra erupted around 17.7+-1.38 ka,has slightly bimodal, and the group which K_2O content is rather little (SiO_2; 77.7wt%,NaO_2; 3.23wt%,K_2O; 3.97wt%) is similar to the geochemistry of pumices in Tephra1.

Nt-S/I is originated from Nantaisan, which belong to the Nikko volcanic area, west Tochigi Prefecture and consisting of Shichihon-sakura pumice unit (SP; Kanto Roam Kenkyu Group, 1965) as upper part and Imaichi pumice unit (IP; Kanto Roam Kenkyu Group, 1965) as lower part.These fall-out pumice units involving scoria distribute toward east from the source mainly, and its correlatives are found at the Kinu River Lowland area, around Mito and furthermore the Jyoban Coast (Machida and Arai, 2003; Suzuki, 2011).As Nt-S/I correlatives in Tephra 1 are almost pumice grains and there are much contaminated grains in fine materials of Tephra 1,it seems less possibly that Nt-S/I tephra fell out at this site off Kashima. We suppose, as a highly probable transportation process, that Nt-S/I pumice grains falling out at sea off Mito, or carried out to the Pacific by the Kinu River and the Naka River are transported off Kashima by marine current.

Then, Suzuki (2011) reported that Asama Itahana Yellow tephra (As-YP; Machida and Arai, 2003) found just under Nt-S/I around Nikko area. Twenty three tephra beds in this core Aoki (2008) reported are visible tephra beds, so As-YP would be bearing under Tephra 1 that correlated to Nt-S/I.

Keywords: Nantaisan Shichihon-sakura/Imaichi tephra, tephrostratigraphy, oxygen isotopic stratigraphy, IMAGES, marine core, off Kashima

Reexamination of the eruptive age of Late Pleistocene widespread DKP tephra by using MD01-2421 core collected off the Kashima-Pacific coast, Japan

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DKP tephra derived from the Daisen volcano, west Japan, is one of the most important Late Pleistocene widespread tephras because it covers a broad area including Central Japan, North Kanto and South Tohoku where inland fluvial terraces formed in the Last Glacial Period are well developed. It also plays an important role as a useful key bed for evaluating paleo-climate changes and crustal movement and so on in this period. However, the age of DKP is highly controversial since the end of 1970s, that is, 45–47 ka (Machida and Arai, 1979), ca. 50 ka (Takemoto, 1991), 50–52 ka (Nakamura et al., 1992), >55 ka (Machida and Arai, 2003), 49–53 ka (Yamamoto and Hasebe, 2014), 55–66 ka (Suzuki et al., 2016). In order to determine the reliable eruptive age of DKP, we examined MD01-2421 core collected off the Kashima-Pacific coast, Japan.
Hakone-Tokyo Tephra (Hk-TP) is crucial tephra for determination of the eruptive age of DKP because it is positioning immediately above DKP. However, characteristic properties for the identification of DKP in volcanic soil deposits just above Hk-TP are insufficient, and the age of Hk-TP have been estimated to be older (e.g. 66.0±5.5 ka: Aoki et al., 2008) than previous studies.
In this study, we detected fine white pumice clasts (0.2 mm in diameter) with characteristic properties similar to those of DKP at a depth of 2018.20–2020.45 cm (93.45 cm above Hk-TP). Refractive indices of volcanic glass shards is 1.508-1.514, and major element composition (wt.%; mean and standard deviation for 15 measurements) in those is SiO_2: 73.57 (0.34), Al_2O_3: 14.74 (0.14), FeO: 1.90 (0.12), CaO: 2.12 (0.05), K_2O: 2.55 (0.09), Na_2O: 4.13 (0.34). These features are quite similar to those of well preserve DKP tephras in terrestrial sediments collected in Toyama and Fukushima Prefectures. Stratigraphic position where these pumice clasts were detected is dated at 60.08±5.68 ka (MIS 4.0–4.22) due to oxygen isotope stratigraphies shown by Oba et al. (2006) and Martinson et al. (1987).

Keywords: Widespread tephra, Late Pleistocene, DKP, marine tephra

Reconstruction of sedimentation rates during the last ca. 50,000 years using multiple cores in Lake Suigetsu, central Japan

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Lake Suigetsu in Fukui Prefecture, central Japan, is a one of the tectonic lake located in a subsiding area related to the active Mikata reverse Fault (Okada, 2004). The sediments of Lake Suigetsu annually laminated over the last ca.70 kyr (Nakagawa et al., 2012) with a significant number of event layers (e.g. associated with earthquakes and floods; Schlolaut et al., 2014), which record paleoclimate and palaeoenvironment changes. Two long cores (SG93, SG06) have previously been recovered from the centre of the lake in 1993 and 2006, respectively, and an exceptionally precise age model has been established for the cores through a combination of over 800 radiocarbon dates and high precision varve counting (Staff et al., 2011; Marshall et al., 2012; Schlolaut et al., 2012; Bronk Ramsey et al., 2012). Recently, new cores (SG14) were recovered by the Fukui prefecture from boreholes ca. 500 m to the east of the SG06 coring site. In this study, we report those sedimentation rates of Lake Suigetsu during ca. 50,000 years and its triggers on the basis of these cores and the precise age model.

The SG14 core was obtained from 4 separate boreholes (E, F, G, H) to ensure overlapping with each other. Half cut sections of these cores were immediately photographed before oxidizing under precisely controlled lighting conditions. Furthermore, long soft X-ray images were taken on 1 m long giant thin-section slabs of these cores. On the basis of these images, we stratigraphically correlated the SG14 core with the SG06 core at more than 300 points in ca. 70 m lengths using a number of event layers to apply the precious age model of the SG06 core.

Focusing on the age of 0 to 50 ka, the SG14 core was deposited at 0.5 m/kyr and show strong correlation with that of the SG06 in depth. The rate increases after 13 ka and has gradual several thousand-year cycles. These cycles may relate to global environmental change. Furthermore, the rate drastically increases at the some horizons, which are able to classify into two types on the basis of comparison with the rate of the SG06 core: synchronous type and asynchronous type. The synchronous type increase the rate in each site at the same time, indicating the rate is likely affected by relatively large-scale event. On the basis of the age model, one of the this type is correlative with Kanbun historical earthquake in 1662. Therefore, this type may be induced by tectonic event. The rate of asynchronous type is clearly different between each site, indicating the rate is strongly affected by local event such as turbidites. As a result, we probably detected global environmental changes, tectonic events, and local events on the basis of high precise correlation between the SG14 and SG06 cores. Additional correlation data between the SG14 and SG06 are necessary in future research to improve understanding of the sedimentary process of Lake Suigetsu.

Finally we thank the SG14 coring members of Richard A. STAFF, Ikuko KITABA, Junko KITAGAWA, Tsuyoshi HARAGUCHI, Victoria C. SMITH, Danielle McLean, Katsuya GOTANDA ,Paul G. ALBERT, Masayuki HYODO, Yoshiaki SUZUKI, Hayato MATSUSHITA, and Akiteru YAMAZAKI for sampling and other hard woks.

Keywords: sedimentation rate, Lake Suigetsu, varve, earthquake

Temperature change in northern Japan during the last 6,700 years and the related human activity

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Marine coastal sediments provide a big advantage to have continuous record of both marine and terrestrial environments in their sedimentary sequence. In addition, high correlation between atmospheric and sea surface temperature in bays present very unique opportunity to reconstruct terrestrial temperature quantitatively. In this study we therefore collected one core from semi-closed bay in southern Hokkaido. We measured organic material of alkenone and analyzed pollen assemblage to estimate temperature. Our goal was to reconstruct with high time resolution of temperature in marine and adjacent terrestrial environments, to evaluate the process behind long and short term trend of temperature for the last 6000 years, and to understand the relationship between climatic changes and the human activity including the rise/fall of the human population at the Sannai-Maruyama site. This time Core St. 5 was collected rat a distance of only 7.8 km from the coast and at a water depth of 65 m of Site 5 in Uchiura Bay during the research program by Geological Survey of Hokkaido in 2010. Then we analyzed alkenone SST. It showed a variation of 8.7 °C (maximum and minimum of 14.5 °C to 23.2 °C, respectively). The mean SST was 14.5 °C. The SSTs gradually increased during the last 7000 years. The SST peaked in 4529 BC, 2546 BC, 759 AD and 1782 AD. Smaller peaked in 4057 BC, 3585BC, 3018BC, 1885BC, 1508 BC, 1035 BC, 469 BC, 122AD, 381AD, 1164 AD. Large temperature falls occurred in 4500-4000 BC, 2550-2000 BC and 760-1080AD.

Keywords: temperature, Jomon people, Climate

Abrupt cooling event during the middle Holocene from pollen data of marine costal sediments in Uchiura bay, northern Japan

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Holocene climate records provide valuable information for inferring past interaction between humans and environment. We present well dated pollen data covering the last 7,000 years from Uchiura bay in southern Hokkaido, norther Japan, in order to better understand the change of human population for the Jomon sites around northern Japan. In addition, we show the palaeoclimatic reconstructions since the middle Holocene from the pollen data, using the best modern analogue technique (MAT). The pollen-based quantitative palaeoclimatic data in Uchiura bay indicate that small-scale cooling events took place at ca. 4.2-4.5 ka cal BP, 2.3-2.4 ka cal BP, and ca. 1.0-1.2 ka cal BP. From the data, the temperature at ca. 4.2-4.5 ka cal BP drastically decreased about 1.5 °C. The cooling at the period corresponds to the decrease of alkenone-SST in Uchiura bay and other palaeoclimatic records throughout East Asia. We can suggest that the abrupt cooling event at ca. 4.2-4.5 ka cal BP influenced human activities and population during the Jomon period in northern Japan.

Keywords: pollen data, palaeoclimatic reconstruction , modern analogue technique , Uchiura bay, northern Japan

Food Diversity, Climate Change and the Resilience of Subsistence-Settlement Systems: A Case Study from the Jomon Period

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Archaeololgists have long been interested in the study of the mechanisms of long-term culture change. Factors that involve specialization and centralization, such as domestification of plants, technological developments and social competitions, have been proposed as prime movers for the "development" of human societies. Contrary to these interpretations, this presentation proposes a hypothesis that diversity and decentralization may be critical for maintaining long-term sustainability of human societies in the order of hundreds to tens of thousands of years. Using the research outcomes of a Full Research Project "Long-term Sustainability through Place-based, Small-scale Economies: Approaches from Historical Ecology" at the Research Institute for Humanity and Nature, Kyoto, this presentation aims at testing the hypothesis discribed above and examining the long-term impacts of the loss of subsistence/food diversity in relation to other environmental and cultural factors. The theoretical genesis of this project is the approach of historical ecology, which conducts comprehensive research on long-term culture change while emphasizing the impact of human activities on the environment.
Results of lithic assemblage analysis, residue analysis on pottery, starch grains analysis on stone tools, stable isotope analysis of skeletal remains and faunal remains, and AMS radiocarbon dating of skeletal remains are used to understand changes through time in food and subsistence diversity and other cultural factors. These results are compared against the patterns and timings of climate change identified through pollen analysis and alkenone sea surface temperature analysis. In addition, GIS analyses are conducted to understand changes in settlement size and site distribution patterns. Simulation studies of population dynamics of the Early to Late Jomon periods using SPD (summed probability distribution) analysis are also conducted.

Keywords: Food diversity, Climate change, Resilience, Jomon, Subsistence-settlement systems

Long-time sastainability of prehistric subsistence of Jomon culture.

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In order to reconstruct the variability of dietary habit among individuals and/or population of Jomon periods, we are investigating the carbon and nitrogen isotope ratios in human bones from the Tokyo Bay area and Aomori prefecture. One of the main goals is the comparison of Jomon dietary habits in the latter part of Jomon periods in light of diversity, variability and sustainability. Our testing hypothesis is that “the Middle Jomon started an intensive exploitation of plant resources and this strategy decreased the resilience of Jomon subsistence and 'a population collapse' was observed in the Late Jomon period”. Now we are working on the series of Middle, Late, and Final Jomon skeletons (ca. 6 to 3 thousand years BP) from the Tokyo Bay area and Aomori prefecture. The comparison between two Jomon sub-groups provide an insight into the response of Jomon hunter-gatherers against cooling and regression events in this periods and social change in time series as well by comparing diversitie of diet among social members.
We would liket discuss the change of carbon and nitrogen isotope ratios in both ecological and social points of view.

Keywords: physical anthropology, prehistoric archaeology, isotope ecology

The estimation of formation ages of fans at the eastern foot of Ikeda Mountains, central Japan by the AMS^{14}C dating and re-examination of average slip rates of Ikedayama fault

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A number of small fans have been developed at the eastern foot of Ikedayama Mountain of Ibuki Mountains, central Japan. These fans are regarded as useful landforms in evaluating the reverse fault activity of Ikedayama fault, dividing from the Nobi Plain, because it runs across the terraces with different ages. The average slip rates of Ikedayama fault, with a length of ca.16 km, was once evaluated as 0.8-0.9 m/1,000 years (Gifu Prefacture, 1998, 1999, and AIST), and recently, re-evaluated as 0.4-0.7 m/1,000 years in the area of northern margin, and 1.3-1.7 m/1,000 years or more in the central part of fult (Ishimura, 2010). On the other hand, we have been carried out AMS ^{14}C dating of humus developed on the debris-flow fan deposits, and classification of the terrace landforms in order to clarify the geomorphologic development process of these small fans. Our results show the estimated age of terrace surface as 17-20ka (upper surface), 10ka (middle surface (upper)), 9ka (middle surface (lower)) and 8ka (lower surface) (Takaba et al., 2016). These ages clearly differ from those estimated by the detection of crypto-tephras from the topsoil (Ishimura, 2010). Therefore, we consider the necessity for re-examination of the activities of Ikedayama fault, again. In this study, using the Fundamental Geospatial Data (Digital Elevation Model of 5 m mesh) by the Geospatial Information Authority of Japan, the fault vertical offsets on the terrace surfaces of same age were measured. They are 9-10.5 m in the upper surface of the northmost part, 10-11 m in the middle surface (upper), 8-10 m in the middle surface (lower), 9-11 m in the middle surface of the central (lower), 6-7 m in the lower surface, 2-2.5 m in the lower surface of the south, and 1.5-2 m in the lower surface. Based on the estimated ages of the terrace serfaces and their vertical offsets above, the average slip rates were calculated to 0.45-0.53 m/1,000 years (the upper surface), 1.0-1.1 m/1,000 years (the middle surface (upper)), 0.89-1.18 m/1,000 years (the middle surface) in the north part of fault, and 1.00-1.29 m/1,000 years (the middle (lower) surface), 0.71-0.88 m/1,000 years (the lower surface) in the central part of fault, and 0.18-0.25 m/1,000 years and,0.24-0.32 m/1,000 years (the lower surfaces) in the south part of fault. Although the lower values should be discounted, the representative average slip rate of Ikedayama fault can be 0.8-1.2 m / 1,000 years, close to the estimate by the Gifu Prefecture (1998, 1999).

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Keywords: Ikedayama Fault, Average Slip Rates, Offsets

Quaternary activity of the Erciyes fault southeast of the Kayseri basin, Turkey

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The Erciyes fault in southeast of the Kayseri basin is one of the most significant Quaternary faults in Central Anatolia, together with the Ecemis fault and the Tuz Golu fault. Emre et al. (2011: New active fault maps of Turkey, Kayseri sheet) mapped about 100 km long strands of the Erciyes fault with its 30 km long southwestery section run across the center of the Erciyes volcano. A M 7+ earthquake from the fault might be a big threat for the 1.5 million people in Kayseri basin, but little has been known about its Quaternary activity and the reality of the fault traces on the volcanic edifice. We have studied Plio-Pleistocene ignimbrites and Quaternary sediments in southeast of the Kayseri basin and recognized significant dip-slip separation in the central portion east of Kayseri city and Quaternary left-lateral (?) strike-slip activities in the northeastern portion of the fault as they are mapped by Emre et al. (2011). Along with field observations, we applied a high-definition topographic mapping approach using a small unmanned aerial vehicle (sUAV) and structure-from-motion (SfM) multi-view stereo photogrammetry. This enabled us to generate topographic data with a resolution of centimeters for a range of hundreds of meters, which were used to identify small topographic features such as scarps on the land surface.The Valibabatepe (or the Incesu) ignimbrite dated as 2.52±0.49 Ma (Aydar et al., 2012) or 2.6 to 3.0 Ma (Le Penne et al., 2005) is a very distinctive extremely densely welded thin (~5 m) and hard ignimbrite layer capping the plateaus around western Kayseri basin. At Gesi Guney, 18 km ENE of Kayseri city center, the Incesu ignimbrite is distributed both on the 1340 m a.s.l. plateau and on the 1250--1270 m a.s.l. upland below the plateau. The ~70 m high scarp clearly demonstrates the Quaternary activity of the Erciyes fault. At the base of the scarp, talus deposits are juxtaposed with bedrock ignimbrite with an apparently NW dipping normal fault. An alluvial fan formed by a gully cutting into the Incesu plateau is also deformed by the fault. Around Gunesli, 25 km northeast of Kayseri city center, a fluvial gravel and sand layer that postdates the Valibabatepe ignimbrite is distributed along the foot of upland consists of pyroclastic flows older than the Valibabatepe ignimbrite. The fluvial gravel and sand layer, together with underlying pyroclastic flow deposits and an overlying pumice fall layer, is truncated by a swarm of vertical faults and dragged into the fault zone. The fault zone structure indicates the faults are strike-slip faults. These faults are located about 100 m inside the upland there is no offset topography on top of the faults. The ages of the faulted tephra layers are not known yet, but it is clear that significant strike-slip fault movement occurred during Quaternary after the Valibabatepe ignimbrite.

Keywords: active fault, pyroclastic flow deposits, Kayseri

Geomorphological evolution of Notsukesaki barrier spits resulting from seismotectonics along the southern Kuril Trench

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An active barrier system is developed in the Nemuro Bay area along the Okhotsk Sea in eastern Hokkaido, Japan. This presently rare feature consists of a lagoon (the Notsuke Bay), a flood tidal delta, barrier spits, and a tidal inlet that opens into the outer sea of Nemuro Bay and the Sea of Okhotsk. The Notsukesaki barrier spits are active along the northeastern side of the Notsuke Bay, and four spit groups (NBS1~NBS4) can be observed clearly. Using geomorphological and sedimentological methods, we analyzed Holocene sediments around the Chashikotsu lowland and Natsukesaki barrier spits. We dated them using radiocarbon and tephrochronological methods. The Notsukesaki barrier system has been established before 4.0 ka presumed by Ma-d tephra. NBS1, the modern transgressive spit was formed after the 17th century, and NBS2 was caused by the last seismic uplift in the 17th century because Ta-a and Ko-c2 tephra covered the surface of NBS2. NBS3 was uplifted in the 12~13th century, and NBS4 was caused by seismic uplift maybe before the 10th century because Ma-b tephra covered the surface of NBS4. These great earthquakes (Mw8.5~9.1) have occurred at an approximate 500-year interval along the southern Kuril subduction zone. Coastal areas were raised by 3~ m during or just after the earthquakes due to postseismic displacement. Conversely, land subsidence has been ongoing at a rate of about 1.5 mm/year since the 17th century. We conclude that the geomorphological evolution of the Notsuke barrier system has been controlled by the seismotectonics along the Kuril subduction zone.

Keywords: Notsukesaki barrier spits, seismotectonics, southern Kuril trench, geomorphological evolution, eastern Hokkaido

Stratigraphy of the Middle to Late Pleistocene in the southwest Hokkaido, Japan

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The Middle to Late Pleistocene Setana Formation and Ohyachi Formation is distributed in Setana Plain, southwestern Hokkaido, North Japan. The Setana Formation consists of tuffaceous sandstone in Setana Plain. This is sandwiched by the Ohya Formation and Kuromatunai Formation.
Sedimentary age of Setana Formation has been estimated to be 1.2 Ma to 0.6 Ma by biostratigraphic investigation. But there aren't a lot of previous research about Stratigraphic Relation between Ohyachi Formation and Setana Formation and that's geomorphic development.
Recently, Kondo et al. (2016) got Setana Formation's and Ohyachi Formation's conclusive age by OSL. The purpose of this study is to clarify the Stratigraphic Relation and the paleo-environment by Sedimentary age.

Keywords: southwestern Hokkaido, Setana Formation, Stratigraphy

Characteristics and Development Processes of Wetlands on Large-scale Landslide in Ou Mountain Range, NE Japan

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Quaternary volcanoes in the Ou Mountains, northeastern Japan, are occasionally dissected by large-scale landslides with their areas greater than 1 km^2. On these landslide bodies various-size wetlands have been formed in the landslide depressions and contribute to creating mosaic landscapes and biodiversity of landslide areas with the steep scarps and forests. Since establishment ages of wetlands on landslide bodies reflect the timing of landslide activities, simultaneity of wetland formation in a single active landslide is inferred. However a large landslide contains coexisting wetlands of various development stages, including ponds and peat bogs. This contributes to further diversity of their landscapes and biota. This study examines geomorphological controls on the distribution and development of wetlands on large-scale landslides in the Ou Mountains.
We mapped in detail the microtopography of the landslides and identified ponds using color aerial photographs (1 : 18,000 and 1 : 15,000 scale) taken by the Geographical Survey Institute in 1976. We then calculated the slope inclination and the curvature, and mapped the drainage system from the GSI (the Geospatial Information Authority of Japan) 5-m or 10-m digital elevation models (DEM) using ArcGIS.
We selected 3 landslides in the Hachimantai Volcanic Groups and 2 in the Funagata Volcanic groups. These landslides have degraded caprock structure of the soft Neogene tuff covered with lava flows. The landslides on the Hachimantai are rotational ones that feature arcshaped scarps and stepped terrain in their upper parts. They have more fragmentary structures in their middle and lower parts. The secondary landslides commonly deform the feet of main landslides and contribute further to the undulating surface. Whereas these on the Funagata Mountain are translational landslides that feature rectilinear shaped scarps and constant height of block structures due to tensile stress.
Wetland distributions are controlled by microtopography of landslide bodies, and the wetland area is determined by the size of the depressions. The wetlands are mostly elliptical shape with long axes parallel to the linear depressions. On the Hachimantai, the wetlands in the middle and lower part of the landslide bodies tend to be smaller due to fragmentary topography. On the secondary landslides, a few wetlands stand only at the foot of the main scarps or in the depression between pressure ridges, because the soft material (earth flow) could not form depressions perpendicular to the slope direction. On the Funagata Mountain, the wetlands stand in the depressions between the scarps and in the cracks that are widely scattered over the landslide bodies.
All landslides in this study contain both ponds and peat bogs, different development stages. Sediment accumulation, connecting drainage channels and shortage of water recharge are considered to be major factors of wetland development from ponds to forests via peat bogs. The superposition map of the wetland distribution and the drainage system draws that the greater part of wetlands are connected to drainages whether water constantly flows or not through them. The peat bogs or forests (the latter stage of wetland development) tend to connect to higher order deeper streams. Therefore the degree of fluvial dissection of landslide bodies controls wetland development stage on the landslides. Landslide dams, such as the Nagamuma on the Funagata Mountain, with abundant recharge water from the upstream area could continue to be pond for a longer time than the other wetlands.

Keywords: wetland distribution, landslide, development process, Ou mountains

Relationship between Holocene sequence of the Tsuya plain and subsidence trend along the southern Sanriku coast, northeast Japan

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The Sanriku coast has some small alluvial plains at environments of rias coast. Although lithofacies of the incised valley fills is reported in some alluvial plains in the Sanriku area, formation process of the valley fills had not been discussed on the basis of many radiocarbon ages in the previous studies since 1980's . Knowledge of incised valley fills with many radiocarbon ages can be basic and important data for not only understanding of formation process of alluvial plain but also clarification of tectonic history in this area. A sediment core, TY1, was acquired from lower reach of the Tsuya Plain, northeast Japan. Core sediments show shallow marine succession influenced by the Holocene sea-level change. On the basis of twelve radiocarbon ages, accumulation rate is high (> 10 mm/yr) at 9,000 to 7,100 cal BP, low (ca. 0.5 mm/yr) at 7,100 to 2,800 cal BP, and high (3 –5 mm/yr) after 2,800 cal BP. High accumulation rate at early to middle Holocene indicates sedimentation from seaward area during the term of marine transgression. In the regressive phase since the middle Holocene, low accumulation rate in the deltafront deposits and high accumulation rate in the delta plain deposits shows most of sediments are deposited in delta plain area, indicating continuous rising trend of relative sea-level (RSL) during the Holocene. This suggested rising trend of RSL is consistent with previously reported Holocene subsidence in the southern Sanriku coast.

Keywords: Sanriku coast, Tsuya plain, Holocene sequence, radiocarbon dating, subsidence

Tephras and fossil pollen stratigraphy of all-cores drilled in the eastern margin of the Aizu basin, Northeast Japan

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1. Introduction

Aizu Basin is one of tectonic basins aligning with north-south direction in the south part of Northeast Japan. Along the west and east margin of the basin, the West Aizu Basin Fault Zone and the East Aizu Basin Fault Zone, active reverse faults, stretches respectively (e.g. Ikeda *et al*., 2002). Geomorphic development of the basin since Miocene has been discussed by Suzuki *et al*. (1977), Yamamoto (2006) and so on. Activity of both fault zones during the last a few ten thousand years was reported by Fukushima Prefecture (2002) and AIST (2007). Kuriyama and Suzuki (2012) and Suzuki *et al*. (2016) discussed late Quaternary tephrostratigraphy based on analysis of a drilling core (AB-12-2 core, 179.08 m asl) and another boring cores in the western part of the basin.

In this study, we drilled two all-cores (GS-SOK-1, 175.99 m asl, 130 m depth; GS-AZU-1, 208.36 m asl, 100 m depth) in the eastern margin of the Aizu basin. Ishihara et al. (2015) reported analysis of tephras and radiocarbon ages of the GS-SOK-1 core. In this report, we show fossil pollen stratigraphy of the GS-SOK-1 core, and lithofacies of the GS-AZU-1 core and detected tephras.

2. Fossil pollen stratigraphy of the GS-SOK-1 core

15 muddy sediment samples were collected from GS-SOK-1. The Pleistocene sediments in the GS-SOK-1 were divided into 10 local pollen assemblage zones (SOK-I, -II…, and –X, in ascending order) an informal nomenclature by a distinctive assemblage of taxa, indicating local environmental conditions as a rudimentary biostratigraphic classification. We compared these zones with local fossil pollen assemblage zones of Nanaorezaka Formation (lower Pleistocene) and Todera Formation (middle Pleistocene) in the western margin of the Aizu Basin (Suzuki *et al*., 1990).

Because Tertiary flora (*Metasequoia*, *Keteleeria*, *Carya*, *Liquidambar*) are slightly included in the SOK-I zone (the depth of 111.1 ~ 126.8 m), the SOK-I zone can be correlated with TD-I zone (Nanaorezaka Formation; Suzuki *et al*., 1990). SOK-II, -III, and -IV zones (78.1 ~ 104.3 m depth) can be compared with TD-II ~ -IV, -V ~ -VI, and -VII zones (Todera Formation; Suzuki *et al*., 1990), respectively. SOK-V ~ -X zones (23.5 ~ 72.9 m depth) includes *Fagus* and *Quercus* dominantly (except SOK-V zone), whereas Pinaceae are detected dominantly in the upper part of Todera Formation in Suzuki *et al*. (1990). Thus, it is suggested that these zones are younger formation than the Todera Formation.

3. Lithofacies of the GS-AZU-1 core and detected tephras

In the depth from surface to 52.5 m, dark grey or green grey silt, peat, and sand are dominant excepting gravel layer in the depth of 36.5 ~ 41.6 m. Several volcanic ash and pumice layer are detected. Characteristics of volcanic glass shards and containing colored mineral indicates that AT (29-30 ka; Machida, 2011) is included in the depth of 13.35 ~ 13.38 m and Aso-4 (87 ka; Aoki *et al*., 2008) is in 30.25 ~ 30.30 m. A lot of biotite are contained in a pumice layer (34.10 ~ 35.10 m) and a volcanic ash layer (52.35 ~ 52.40 m), indicating that they were supplied from the Oku-Aizu (Numazawa or Sunagohara) Caldera.

From 52.5 m to 91.3 m depth, green grey or yellow brown sandy silt or sand with pumices and phenocrysts mineral such as quartz are dominant and a thin gravel layer is at the depth of 76.3 ~ 78.7 m. It is suggested that these sandy silt and sand layers are pyroclastic flow sediments and

their rework sediments. Below 91.3 m the core consists of yellow brown or grey white volcanic sand and silt. The pyroclastic flow sediments can be correlated with the Shirakawa pyroclastic flow units (lower Pleistocene; Yoshida and Takahashi, 1991; Yamamoto, 2006) if above volcanic ash layer is the tephra from the Oku-Aizu Caldera.

Keywords: Aizu Basin, Boring, Tephra, Fossil pollen, Quaternary

Tephra of the Upper Pleistocene Joso Formation, Shimosa Group in the western Tsukuba Upland, central Kanto Plain

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Most of the terraces in the Kanto Plain were formed on and after Marine oxygen-Isotope Stage (MIS) 5e. Palaeo-Tokyo Bay spreaded in MIS 5e was becoming regression gradually. The geomorphic surfaces of MIS 5e were formed by Kioroshi Formation, and the geomorphic surfaces of MIS 5c and MIS 5a were formed by Joso Formation, in the Tsukuba Upland. Joso Formation has been classified by geomorphic surface classification, tephrochronology and sedimentary facies analysis. The purpose of this study is to make the improvement of a time axis in Joso formation from sedimentary facies analysis and tephrochronology targeted for the western Tsukuba Upland over the central Ibaraki Prefecture. The results, 2 to 4 sedimentary units of the marsh and channel facies are recognized Joso Formation in the Ryugasaki Lower surface (Ikeda *et al.,* 1982) , Joso surface (Unozawa *et al.,* 1988) and Joso, Ishizuka surface (Ooi *et al.,* 2013) . Hk-TP tephra (66ka; Aoki *et al.,* 2008) is recognized from Kanto loam Formation. On-Ng tephra (about 85ka; Nagahashi *et al.,* 2007) or On-Pm1 tephra (about 96ka; Aoki *et al.,* 2008) , and so on were confirmed from Joso Formation by the mineral composition and the chemical composition of the glass. It's expected that this study offers essential datum about the landform evolution in surrounding Upland and the Joso Formation study.

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Keywords: Kanto Plain, Tsukuba Upland, geomorphic surface, Upper Pleistocene, Joso Formation, tephra

Shallow subsurface structure in Magame - Katakai area, Kujukuri coastal plain, Chiba prefecture

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1.Geological Survey of Japan, AIST

A shallow seismic reflection survey was conducted in the Kujukuri coastal plain, Chiba prefecture, targeting between a dozen meters and 300 m in depth to reveal the location and shape of buried valley topography inferred below the Alluvial sediment. The survey area is along the coast between Magame and Katakai of Kujukuri town where a buried valley is inferred from an existing geological map. The survey parameters are as follows. Line length:4486m, seismic source:P-wave Yuatsu impactor(JMI200), vertical stack:10, source point interval:2m, no. of source point:2242, receiver:GS20-DM(28Hz single), receiver point interval:2m, no. of receiver point:2244, spread:roll along from the first to 48th station for 192 fixed receivers, maximum offset:382m, recorder:DSS-12, no. of recording ch:192. First breaks arrive to the maximum offset and the deepest reflection waves appear down to 500ms in two way time in the vertical stacked and gained shot records. Source and receiver couplings to the ground seem good on a sandy beach. Reflectors are perceived between a dozen ms and 250ms in the CMP stacked time section. A reflector is strong and continuous, dips northward very gently between 20ms and 30ms in the whole seismic section. It seems obscure at two parts. Assuming that the velocity is 1.6km/s, this reflector is between -16m and -24m below sea level. This is 10m to 20m shallower than the Alluvial depths of the above geological map, but almost the same as those of the compiled boring data. This reflector is considered as the Alluvial base. In the southern obscure part, first breaks of near offset traces are superimposed by coherent noise. Discontinuous reflectors of 100m to 200m in length exist between 40ms and 70ms dispersively. These may have something to do with natural gas (Uwa gas). Reflectors are obsucure between 100ms and 170ms and reflectors are strong and uneven between 170ms and 250ms. Below the Alluvial sediment are strata of the Kazusa group.

Keywords: Kujukuri coastal plain, seismic reflection survey, Alluvial base, buried valley

On-Pm1 tephra and marine deposits covering the tephra in the Choshi district, eastern Kanto Plain

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In the Choshi district, eastern Kanto Plain, Shimosa Upper Terraces are widly distributed which are composed by the Katori Formation correlated with the Kioroshi Formation of the Shimosa Group. Shimosa Lower Terraces and younger geomorphologic surfaces are distributed in the east side of the Choshi district (Sugihara, 1976; 2000; 2008). Nakazato et al. (2015) detected the tephra that abundantly contained pumice type volcanic glass and hornblende. They showed the possibility of the correlation between the tephra and On-Pm1, based on the refractive indices and chemical compositions of the volcanic glass and hornblende.
The Zircon U-Pb dating using LA-ICP-MS (Ito, 2014) was applied to the tephra in this study. As a result, the obtained age of 100±60 ka improved the reliability of the correlation between the tephra and On-Pm1.
The outcrop where the tephra was detected shows the following stratigraphy: mud and sand stone of the Kasuga Formation of the Inubo Group, unconformity, shoreface sand, terrestrial mud interbedding the tephra (On-Pm1), shoreface sand with *Macaronichnus* isp., beach sand, fluvial deposits, Younger Kanto Loam and Holocene dune deposits in ascending order. The age of marine sand overlying the On-Pm1(95.7±5.3ka: Aoki et al., 2008) is more likely to be MIS5a.
Reexamination is necessary about the geomorphic and geotectonic history in this district because it has been assumed that the MIS5a surfaces are distributed in lower altitude area than this point.
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Keywords: MIS5c, tephra, geomorphic surface

Evolution process of the oyster reef and the ecology in Sanzanze, northeast Tokyo bay

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Living oyster reefs were first found about early 2000s at Sanbanze, a sandy and muddy tidal flat in Funabashi City at the northeast end of Tokyo Bay. Large reefs of Crassostrea gigas emerged only at the lowest point of spring tide, attracting public attention. After the peak of the development of the oyster reefs in 2008, the activity started to decline in 2009 and the ecosystem have been changed. The evolution process of the ecosystem, and its response to environmental conditions around the reefs, are key to understanding the present ecosystem, and also the environmental changes.
Oyster reefs, and also size and shape of individual oyster shells must be influenced by such environmental factors as nutrient salt, water temperature and habitat density in addition to weather condition, salinity, turbidity and so on (Chinzei, 1982, etc.).
In this study we investigate the relationship among changes in morphology through the growth of oyster reefs and individual shells, evolution process of the reefs and environmental factors in and around the reefs.
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Keywords: Tokyo bay, Oyster reef, Evolution process

Depositional system of the early Pleistocene Inagi Formation, Kazusa Group in the northwest Tama Hills, central Japan

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The Tama Hills is composed by the late Pleistocene to middle Pleistocene Kazusa Group. The Kazusa Group is typically distributed in the Central Boso Peninsula and composed underground of the Kanto Plain and hills edging the plain. Fossils of mollusk, animals and plants occur from shallow marine to non-marine Kazusa Group in the Tama Hills. Because, the Kazusa Group of the Tama Hills reflects environmental changes such as eustacy, it is important to reconstruct the paleo-environmental change the Early Pleistocene in the southern Kanto region with investigation of this area.
In this study, we focus on the Inagi Formation distributed in the northwest Tama Hills. The lower to middle member of Inagi Formation are composed of gravel and sandy silt respectively, whereas the upper Member of is composed by sand (Takano 1994). Kikuchi (1984) estimated that the formation of northwest Tama Hills is delta. The upper Member of Inagi Formation was estimated as delta topset. Shirai and Imamura (2013) reported barrier island, estuarine and shoreface sediments from the upper Member.
We estimated the depositional-environments of Inagi Formation with a facies analysis. The top of sand layer from middle mud layer in Inagi formation divided to the estuary unit, barrier island unit, shoreface-foreshore unit, Bay-head delta unit. Therefore, it was estimated that a comprehensive barrier island system include these four depositional units as a “small” estuay whithin a “brood” back- barrier area. The estuary formed very broad bay accompanied by the barrier island overlying of the bay-head delta unit on the shoreface-foreshore unit implies that estuary and tidal-channel unite may have been formed.

Keywords: Facies analysis, Kazusa Group, Inagi Formation, estuary

Holocene Landform Evolution at the South of Lake Idku, Northwest Nile Delta, Egypt, Reconstructed from Settlement Location and Sediment Cores

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1. Background & Objective

The Nile Delta has been formed in the mouth of Nile River, northern Egypt. It is said that Nile Delta started to be formed at 7,000 yr BP when due to the decline of the speed of the worldwide sea-level rise in post-glacial age sediment supply carried by river was piled in the depositional space (Stanley and Warne, 1994). And in the case of Nile Delta, sea-level has been still rising in 1,000-year order and now it's highest since post-glacial age caused by a compressive settling of delta deposits (Warne and Stanley, 1993). Besides it is a zone of arid environmental conditions called desert climate. Therefore, Nile Delta has been modified complicatedly by various forms of depositions; fluvial, marine and aeolian. So it is significant to examine the micro-topography using higher resolution.

This study focused on specific site and aimed to reconstruct landform evolution from analysis of three sediment cores drilled by Cairo Univ. in 2012 and settlement location.

2. Study Sites & Methods

This study focused on the site of Lake Iduk in the east of the Rasheed branch. There is a Roman archaeological site named Kom al-Diba'a in low land in the south of Iduk. It's located two slightly elevated flat hills which are about 6~8m high and 150~300m across. In this thesis the following methods were used ; landform classification by satellite photography using GIS software, field investigation of the study site, sedimentary facies analysis, soil color analysis, magnetic susceptibility analysis, grain size analysis, elementary analysis, 14C dating.

3. Result & Discussion

Geomorphology and Geology of Kom al-Diba'a

By investigation of Kom al-Diba'a outcrop and sample analysis; magnetic susceptibility analysis and grain size analysis, it is found that two slightly elevated flat hills are eolian sand dunes consisting of well-sorted medium~fine sand. Besides, the upper part of the south hill's outcrop is alternation of sand and silt which is assumed to be flood deposits.

Geomorphological Changes in the area of Lake Iduk

As a result of analysis about a sediment core drilled in former lagoon site of Lake Iduk, it can be divided into the following three stages and estimated sedimentary age; AB-boundary: 3000~4000 yrBP, BC-boundary: 1500~2000 yrBP. Thus, geomorphological changes in the area of Lake Iduk were reconstructed by these three stages. Thus, geomorphological changes in the area of Lake Iduk were reconstructed by these three units.

A: Iduk was connected to the Mediterranean Sea as a gulf. It was a depositional situation by inflowing of beach ridge sediments due to waves or small transgression and of flood deposits transported by the Nile. (Sand layer and element fluctuation)

B: Iduk was expanding especially to the east side caused by a compressive settling of delta deposits and flooded land area reduced in consequence. (Reduction of sand layer and element fluctuation)

C: Iduk was unconnected to the Mediterranean Sea due to beach ridge sediments transported from the mouth of Rasheed branch by coastal current. (Decline of sulfur concentration)

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