Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HQR23-P01 Room:Convention Hall Time:May 24 18:15-19:30

The reports of seismic reflection survey in the eastern coastal area of Boso Peninsula

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AIST has conducted the coastal project since 2008 in order to equip seamless geoinformations of land and sea (e.g., Sato, 2014). This project has approached the eastern coastal area in Boso Peninsula since 2014 and this study reports the preliminary results of the subsurface structure in the area.

Some characteristic geological structures distribute in Boso peninsula. The Kamogawa-teichi fault zone extends to east-west direction at southern part of the Boso Peninsula (Murai and Kaneko, 1975; 1976). The Kashima-Boso uplift zone including some uplift axes locates from the Kashima area to the Boso Peninsula (Kaizuka, 1987). Additionally the Japan trench, where the Pacific plate are subducted under the Eurasian plate, is located on the east of Boso Peninsula.

The survey area is the eastern coastal area of Boso Peninsula and the total length of the survey line is 630 km. The method of this survey is seismic reflection by boomer equipped with boats. A Streamer cable has 24 channels with 3.125 m spacing.

The survey area is subdivided into the Kujukuri area and the Kamogawa area based on topography and geological structures. The Kujukuri area is characterized by broad shelf with 150 m in depth and existence of the Katakai canyon. Two strata bounded by unconformity distribute in this area and this study defines them as the Kujukuri A Unit and the Kujukuri B Unit, in ascending order. The Kujukuri B Unit has some synclines and anticlines, which strikes are toward both north-south and east-west direction.

The Kamogawa area is characterized by the Kamogawa canyon and narrow slope. The strata in the area are subdivided into the Kamogawa A Unit and the Kamogawa B Unit in ascending order. The Kamogawa A Unit is further subdivided into some subunits related to sea level cycle. Although there are no data for sedimentary age, the Kamogawa A Unit could correlate to the Kujukuri A Unit. The progradation pattern forward the land can be observed within the Kamogawa B Unit. Additionally there are some faults fallen toward westward.

The strata distributed in Kujukuri area could be correlated to the Shimousa Group and those in Kamogawa area could be correlated to the Awa Group respectively, although more investigation should be required.

Keywords: he eastern coastal area of Boso Peninsula, seismic reflection survey, the Kujukuri area, the Kamogawa area

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Alluvium stratigraphy and basal topography in the southern part of the Kujukurihama Lowland, central Japan

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Alluvium stratigraphy and basal topography in the southern area of the Kujukurihama Lowland, Boso Peninsula, central Japan are reconstructed on the basis of numerous number of borehole logs and radiocarbon datings. The Alluvium in this area is divided into two patterns of succession. Pattern I is composed of estuary muds (20-30m in thickness), shoreface-beach sands (up to 20m), and lagoon-floodplain muds (about 5m), in ascending order. Pattern II, while, is almost the same as the Pattern I without the estuary muds. Radiocarbon ages show that estuary muds and shoreface-beach sands were deposited during a transgression stage 12,000-9,000 calBP and a highstand stage 7,000-5,000 calBP, respectively. The radiocarbon ages of shoreface-beach sands shows younger toward the seaward, that means that the shoreface-beach sands prograded after a maximum highstand stage. The boundary between the Alluvium and the Pleistocene deposits is recognized by N-value, which is based on the hardness of sediments. The basal depth of the Pattern II shows that the boundary forms somewhat flat surface inclined to offshore direction. On the basis of the distribution of the estuary muds of the Pattern II succession, several incised valleys, which direct from NW-W to SE-E, are revealed. The incised valleys are formed by river-flow from surrounding hills into the Pacific during the Last Glacial Maximum.

Keywords: Alluvium, incised valley, Last Glacial Maximum, Holocene, Kujukurihama, Mobara

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Paleoflood reconstruction using peat ash in the Ishikari Lowland, northern Japan

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Previous studies of paleoflood reconstruction often focus on slackwater deposits, and they have discussed the relationship between the frequencies of rare, large floods and regional climate changes. On the other hand, paleoflood reconstruction using overbank deposits are scarce because it has many problems.

The relative amounts of the clastic sediments in peat mainly reflect the overbank sedimentation rate. The sedimentation rate of fine sediments is usually controlled by the flooding duration. Therefore, reconstruction of flood frequency can be made using Loss on Ignition (LOI) of peat.

Ishikari Lowland is one of the largest meandering river systems in Japan, and large peatlands are distributed between rivers. I collected sediment samples using hand-operated auger and measured LOI. Furthermore, I conducted seed analysis to clarify the conditions of nutrients. Radiocarbon dating was conducted on plant fragments, wood pieces and twigs.

The peat has approximately 3-5 m thick, and is underlain by bluish grey clay. Plant fragments are usually scarce in the clay. The patterns of LOI can be classified into 3 categories and they are also characterized by its location. The LOI decreases from 5400 to -3600 cal BP, relatively stabilizes between 3600 and 1500 cal BP, and increases after 1500 cal BP in pattern 1. This pattern is found near the Ishikari River. The LOI just fluctuates between 20 and 80 % and long-term trend is not clear in pattern 2. This pattern occurs near tributaries. The LOI of pattern 3 is relatively high and stable (>70%). This pattern is found in eastern margin of the lowland. The LOI of peat is consistent with the changes in nutrients conditions. Where peat LOI is low, plant species that prefer high-nutrients conditions are found, and vice versa.

Peat LOI is determined by the balance between the overbank sedimentation rate and organic sedimentation rate. They may be influenced by the flood frequency, magnitude of flood, temperature, and plant species composition. However, it is apparent that the changes in LOI are consistent with that of nutrients conditions. Nutrients conditions of peatland are usually defined by the flood frequency. Therefore, peat LOI can be used as the indicator of paleoflood frequency.

The overbank floods of the Ishikari river are usually triggered by the combination of Baiu/Akisame front and typhoon. Therefore, the LOI of pattern 1 can be interpreted as an indicator of the frequency of typhoon. The changes in typhoon frequency estimated from this study are almost consistent with the result of major flood frequency inferred from the Lake Suigetsu deposits (Schlolaut et al., 2014).

Keywords: paleoflood, peat, floodplain, Holocene

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Identification and correlation of tephras in aeolian deposits covering marine terraces on the northern Sanriku Coast

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Numerous geographical or geological researches on the northern Sanriku Coast have been conducted since 1960s. In the Kamikita Plain, Miyauchi (1988) and Kuwabara (2009, 2010) revealed stratigraphic, lithologic and petrographic characteristics of Toya tephra (112-115 ka: Machida and Arai, 2003) which is available as correlation of the Last Interglacial (LIG) marine terraces. On the northern Sanriku Coast, although Yonekura (1966) correlated the marine terraces based on geomorphological analysis and sedimentary facies, few studies focusing on the terrace ages on the basis of tephrochronology have been conducted since then. Thus, this study concerns features of tephra layers (e.g., stratigraphic position, lithofacies, refractive index and morphological classification of volcanic glass shards) in the Kamikita Plain as a reference. We also identified tephra layers on the northern Sanriku Coast based on correlation to those reported in the Kamikita Plain to improve of accuracy for age estimation of the LIG marine terraces.

In this study, we first mapped the LIG marine terraces by aerial photograph interpretation, and then conducted field surveys and collected tephra samples. In tephra analysis, we observed grains in tephra sample under a polarizing microscope and clarified their grain composition and shape of their volcanic glass shards. In addition, for some tephra samples refractive index of their volcanic glass shards were measured by using RIMS2000.

In Kamikita Plain, the Takadate surface (Miyauchi, 1985), one of the LIG marine terraces, is well developed. We collected tephra samples (To-H, To-BP1, To-G, To-Kb, To-Ok_2, To-AP, Toya, ZP2) at Mitateyama reported as a type locality of tephras covering the Takadate surface by Miyauchi (2001). To-H is composed of several fall units. Its volcanic glass shard content is high and its glass type is mainly pumice type. To-Ok_2 is composed mainly of coarse-grained pumice. To-AP contains blue-gray lithic fragments in the upper part of the layer. Toya appears as a gray-white ash layer. Its volcanic glass shard content is high and its glass type is characteristically bubble-wall type. We measured refractive indices of its volcanic glass shards at n=1.493-1.497. These characteristics are similar to the ones in the previous reports (Machida and Arai, 2003; Kuwabara, 2010).

On the northern Sanriku Coast, the Taneichi surface, reported as a LIG marine terrace by Yonekura (1966), are developed at 20-30 m a.s.l.. From field surveys, it is presumed that terrace deposits of the Taneichi surface are marine beds because they consist of well-sorted sand layers and rounded gravel layers, which are similar to modern beach deposits. In addition, we identified four tephra layers (Tephra 1-4 in descending order) covering the Taneichi surface. The Tephra 1 is interbedded with the upper part of aeolian deposits and consist of a few fall units. Its glass type is mainly pumice type, and refractive index of its volcanic glass shard is n=1.503-1.513. These characteristics are similar to To-H and thus we correlated this tephra with To-H. The Tephra 3 is probably correlated with To-AP because it contains blue-gray lithic fragments in the upper part of the layer. The Tephra 2 is probably correlated with To-Ok_2 because of its stratigraphy and consistency with the thickness from an isopach map in Miyauchi (1985). The Tephra 4 is correlated with Toya because its volcanic glass shard content is high, and its glass type is mainly bubble-wall type.

In this study, we found four tephra layers covering the Taneichi surface on the northern Sanriku Coast and preliminarily correlated them with To-H, To-Ok_2, To-AP and Toya. Consequently, we estimated that the Taneichi surface was a LIG marine terrace because Toya covered immediately above marine beds. In the meeting, we will report more detailed petrographic characteristics of the tephras and results of correlation and chronology of LIG marine terraces on the northern Sanriku Coast.

Keywords: the Sanriku Coast, marine terrace, tephra, Toya tephra

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Holocene paleoenvironment and crustal movement in Yamada plain, south of Sanriku coast in northeast Japan

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Background,Objective

The Sanriku coast in northeast Japan forearc is a typical ria coast and has geologically uplifted but geodetically and seismologically subsided (e.g. Miyauchi, 2012) . In order to solve the paradox, Holocene lowland development in south Sanriku coast area is a clue.

The purpose of this study is to clarify the Holocene environmental changes and crustal movement in the south of Sanriku coast areas using drilling core sediments.

Study Area,Methods

This study focused on Yamada plain in Iwate Prefecture in south of Sanriku coast because the plain locates in a typical enclosed environment without marked river systems and located inner part of Yamada bay, and because many borehole cores were drilled and available.

We conducted landform classification, sedimentary facies analysis, grain size analysis, elementary analysis, diatom analysis, identification of shell species, tephra analysis, and high-resolution AMS 14C dating.

Results,Discussion

Reconstruction of Holocene paleogeography in Yamada plain

The alluvium in Yamada plain is divided for five units, based on the facies, grain size, total sulfur content, and occurrence of shell fossils. The paleogeography of the study area can be characterized by four stages associated with glacial eustasy as follows: wetland in the early Jomon Transgression (about 10,000 cal BP-8,000 cal BP; unit1) ; enclosed bay after tidal flat in Jomon Transgression (about 8,000 cal BP-4,200 cal BP; unit2) ; tidal flat or shallow marine in the eastern (sea) side (unit3) and coastal lowland in the western side (unit4) in the period of regression (about 4,200 cal BP-300 cal BP; unit3, 4) ; and wetland or beach ridge (about 300 cal BP-present; unit5) .

Holocene crustal movement in Yamada plain and south of Sanriku coast

To estimate the trend of Holocene crustal movement, we compared the age-depth curve obtained from the core and theoretical sea level curve (Okuno et al., 2014) which does not take into account the local crustal movement. The age-depth curve when Yamada plain was intertidal zone roughly shows local sea-level. Therefore, if the local crustal movement was not in the past, the age-depth curve should overlap with the theoretical sea level during the same time. However, the former is clearly below the latter, indicating that Holocene crustal movement in Yamada plain is more or less subsidence trend. In addition, the average subsidence rate of the past was 1.5-2.3 mm / yr at about 7,500-8,000 years, about 2.3 mm / yr at about 1,700 years.

This study revealed that the trend of Holocene crustal movement in Yamada plain is more or less subsidence trend. This result is the same trend as it of the last 100 years. It is also suggested that the trend of Holocene crustal movement in whole south of Sanriku coast area is subsidence trend by comparing with previous study in Rikuzentakata plain (Niwa et al., 2014).

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Keywords: Sanriku coast, alluvial lowland, Holocene, crustal movement

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Basin fill sediments and late Quaternary tephras under the eastern part of Aizu basin, Northeast Japan

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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. 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. (2013) detected tephras from a drilling core (AB-12-2 core, 179.08 m asl) in the western part of the basin and calculated accumulation rate of sediments since 0.2 Ma as 0.2~0.5 m/ky. However, geological structure of the Aizu basin is still not clear because of lack of chronological studies of underground sediments in the eastern part of the basin. We drilled an all-core (GS-SOK-1 core, 175.99 m asl) with a depth of 130 m at Shiokawa, Kitakata City, located an eastern part of the Aizu basin. In this report, we show stratigraphy of the GS-SOK-1 and detected tephras.

GS-SOK-1 core comprises alternate layers of gravel beds and fine sediment beds in total. From surface to 26 m depth silt and organic silt beds are dominant, although thick gravel beds deposit from 26 m to 60 m. Two tephra layer are detected at 1.6~1.8 m (pumice layer) and 81.1~81.7 m (volcanic ash layer). It is suggested that the former is Nm-NM (5.4 ka) and the latter is a tephra derived from the Sunagohara volcano. Gravel beds composed of subrounded and subrubbled pebbles in size 20-50 mm with cobbles. Andesite cobble and tuff are included in total. Three radiocarbon ages of woods obtained from the core are as follows: 17310-17710 cal yrBP (6.26 m depth), 17330-17730 cal yrBP (6.67 m), and 29530-30360 cal yrBP (7.64 m).

Suzuki et al. (2013) detected three tephra layer in AB-12-2 core; Nm-NM (4.1 m depth), AT (17.1 m), and Sn-MT (88.3 m). If volcanic ash at 81.1~81.7 m depth is compared with Sn-MT, average accumulation rate of sediments since 0.2 Ma in eastern part of the Aizu Basin is comparable with one in western part. On the other hand, GS-SOK-1 core consists of alternate layers of gravel and fine sediment, although AB-12-2 core dominantly comprises fine sediment in total. Boring site of GS-SOK-1 is near fans of eastern margin of the basin and volcanic-fan of Mt. Nekoma, suggesting that coarse sediments have been supplied several time in GS-SOK-1 site.

Keywords: Aizu basin, Boring, Tephra, Underground geology, Late Quaternary

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The lower loam bed and eolian sand deposits found at Tomobe Hills, Middle Part of Ibaraki Prefecture

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The Pleistocene Hikita and Tomobe formations are distributed in the Urizura and Tomobe hills and the Kakioka Basin,the mid-western part of Ibaraki Prefecture. Their sedimentary age remains undefined. As several tephra layers from the lower loam bed and eolian sand deposits overlying the Tomobe Formation were found at the Tomobe Hills, we examined their correlation. Two tephras possibly correlative with ”GoP” and ”HBP”, key tephra beds of the Tama Loam in the Kanto Plain region, respectively were included in the lower loam bed. This indicates the lower stratigraphic position for the Tomobe Formation than the Jizodo Formation (equivalent to MIS11), Shimosa Group.

Keywords: Tomobe Hills, Eolian sand deposit, HBP Tephra, Tomobe Formation, Pleistocene

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Stratigraphic correlation of multiple coring sites in Lake Suigetsu, Fukui prefecture, central Japan

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Lake Suigetsu in Fukui prefecture, central Japan, is a tectonic lake related to the active Mikata Fault (Okada, 2004), which measures 3 km east-west by 3 km north-south. The sediments of Suigetsu are important for Quaternary science, as they are annually-laminated (varved) over the last ca.70 kyr (Nakagawa et al., 2012). The varved sediment also contains a significant number of microscopic event layers (e.g. associated with earthquakes and floods; Schlolaut et al., 2014). Two long cores (SG93, SG06) have previously been recovered from the centre of the lake, 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). In 2014, a new core (SG14) was recovered by the Fukui prefectural government from a boreholes ca. 500 m to the east of the SG06 coring site. This core was obtained mainly for public display but also provides additional samples for the scientific analysis of the event layers, tephras, palaeoclimate, palaeomagnetism, and others. High-resolution photographs of the half-core sections were taken before oxidation could take place, under precisely controlled lighting conditions. Long soft X-ray images were subsequently taken on 1 m long giant thin-section slabs of the core. From there, we visually correlated the SG14 core with the SG06 core using event layers, so the age model from SG06 core can be used for SG14.

The SG14 core was obtained from 4 separate boreholes (E, F, G, H) to ensure overlapping with each other. The combined core sections were nearly 100 m long, going ca. 30 % deeper than the SG06 core, and were almost wholly continuous except for two cm-scale gaps. Almost all of event layers of the SG14 core, such as tephras, turbidites, could be correlated with that of the SG06 core. On the basis of this correlation, average sedimentation rate of the SG14 core was equivalent to that of SG06; however, the coarse layers of turbidites were different in thickness between each core. These observations support the idea that most of event layers spread out over wide areas of the lake bottom. Furthermore the variation in thickness between the cores provides key geographical origin and pathways of these event layers. The upper parts of the SG14 core (0 to 44 m in composite depth) are mainly dominated by varved sediments. Whilst the middle (44 to 65 m in composite depth) and lower parts (65 to bottom in composite depth) of the SG14 core lack laminated sediment; the middle parts primarily consist of massive sediment, and the lower parts are composed of black-brown peat and cyclically intercalated with more inorganic grey sediments. These stratigraphic transitions probably indicate hydrological change of the lake catchment.

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Keywords: Lake Suigetsu, Event stratigraphy, Varve, Turbidite, Stratigraphic correlation

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The growth process of Oyster reefs and Diatom assemblage in Tokyo bay - focus on a genus Amphora of diatoms

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Around the tidal zone of Funabashi coast, Sanbanze, the northern Tokyo Bay, Chiba Prefecture, living oyster reefs appeared abruptly 10 years ago. Here is sandy tidal flat near the river mouth of Edo River, where a few reefs of Crassostrea gigas ranging 100m or 200m long were formed in the lower tidal zone. Some small colonies of C. gigas have been found out at least before 20 years, however, the reason why recently the living oyster reefs appeared around Sanbanze should be clarified in relation to the environmental changes.

In this study, the ecosystems of the oyster reefs are composed of C. gigas, sea anemone, ragworms, seaweeds, seagrasses and diatoms. In particular, we investigate living oyster reefs and diatoms. Oyster feed on diatoms playing a role in the base of food chain. Our field survey checks size of reefs, habitation density in reefs and organisms around the reefs, in comparison with various environmental indicators by the monitoring post of the Bay.

In general only macro-benthos and fishes are treated in the ecosystems of coastal areas, though seaweeds and seagrasses are important to comprehend the ecosystem. Gastropods in tidal zone eat mollusks, seaweeds and seagrasses. In fact, in Sanbanze, sea lettuces (Ulva sp., a kind of seaweeds), grows conspicuously along with seagrasses. A genus Amphora, one of the dominant diatoms in the reefs, is living in brackish to marine water, settling on algae or plants and is useful as an important marker of seaweeds and seagrasses in Sanbanze.

Keywords: Tokyo Bay, Oyster reefs, Diatom, Macro-benthos,, Ecosystem