Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

HQR023-01 Room:303 Time:May 24 16:30-16:45

River Regime of Ghaggar River in the Mid to Late Holocene, Northern India

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It is well known that huge cities of ancient civilization, such as Mohenjo-daro, were abandoned during the post-urban Harappan period. Many reasons for the declination of Harappan culture have been estimated since 19th century, for example huge earthquake, devastative flooding, climate change etc. The Lost Saraswati hypothesis would be one of major estimations for the declination. One of the leading candidates for present remnant of lost Saraswati is the Ghaggar-Hakra River that originates in the Lower and Sub Himalayas of northwestern India. It flows westerly in the Punjab plain and disappears into Cholisthan deseart as a dried river bed. Naruse(1974) and Yashipal et al.(1980) said the Ghaggar had used to connect with glacial area in the Higher Himalayas through the Sutlej or Yamuna River course, however been disconnected by piracy due to crustal uplift or rejuvenation of adjacent river. We have tried to examine the hypothesis from the view point of chronology of flood plains and sand dunes distributed along the Ghaggar River. We resulted that the Ghaggar was not the mighty Saraswati during mature Harappan period because sand dunes on either side of the Ghaggar had been formed before that.

Acknowledgement
This study was supported by the research project titled Environmental Change and the Indus Civilization (project 3-3) managed by Research Institute for Humanity and Nature, Japan.

Keywords: India, Ghaggar River, Holocene, Indus Civilization, Harappan Culture, OSL dating

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HQR023-02 Room:303 Time:May 24 16:45-17:00

Rara lake, the largest lake in Nepal Himalaya, as a pull-apart lake embanked by glacial till

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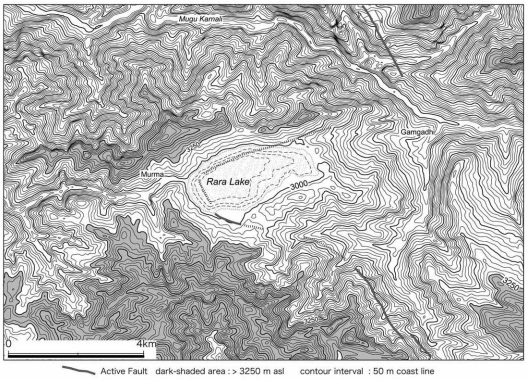
Bathymetric survey of Rara Lake that is the largest lake in Nepal Himalayas was carried out, using an ultra sonic sounder and GPS. The shoreline of Rara Lake is just adjacent to the piedmont line except its southwest corner, where an alluvial fan develops. The alluvial fan is dislocated by an active fault that shows down-throw of eastern side of the fan surface. The bathymetry of the western half of the Rara Lake is box-shaped with a flat bottom deeper than -160 meters below the lake level though the transverse profile of its eastern half shows V-shaped submerged valley. A western margin of the lake is bounded by a steep submerged cliff deeper than 160 meters. It is a continuation of the active fault. The eastern bank of the lake is fringed by narrow embankment composed of the detritus thicker than 100meters. It is very clear that blockage of the mouse of the rhomboid valley has primarily formed Rara Lake due to detritus embankment. How the box-shaped depression in the western end has been formed? The alluvial fan is cut by the active fault that down-threw its eastern side. The active fault is northwestern extension of the Talphi fault (Nakata,1982) that is one segment of the active fault system with dextral displacement along the Main Central Thrust and that steps its trace to Darma fault in the north of Rara Lake. The trace of the active fault clearly continues northwestward to the submerged steep wall of the western fringe of the lake. That implies western half of the lake is tectonic origin due to pull parting that is liable to occur at a step of active faults. Namely, the box-shaped depression located in the western half of Rara Lake has been formed as a kind of pull-apart basin at the step of a series of the dextral active fault, Darma-Talphi active fault system.



Keywords: Rara Lake, Nepal Himalaya, glacial till, embankment, pull-apart lake

Japan Geoscience Union Meeting 2011
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HQR023-03 Room:303 Time:May 24 17:00-17:15

Changes in vegetation and fire regimes since the mid-Holocene around Lake Rara, western Nepal

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Vegetation and fire regime changes since the mid-Holocene were investigated using pollen, plant macrofossil and macroscopic charcoal records in a core sediment (Rara09-4) (29.5347°N, 82.0933°E and 3,000 m a.s.l.) from Lake Rara in western Nepal. The pollen record was divided into two local pollen assemblage zones (I and II), even though it was co-dominated by Quercus and Pinus, with Abies, Picea and Betula pollen throughout the core. In zone I (ca. 6,000 to 3,000 yr B.P.), Quercus pollen had high values of more than 50% of total tree pollen. On the other hand, zone II (ca. 3,000 yr B.P. to present) is characterized by the decrease in Quercus pollen and increase in Pinus pollen. Most of fossil Quercus and Pinus pollen grains were Q. semecarpifolia and P. wallichiana types, based on their SEM identification. Fossil leaves of Q. semecarpifolia type were founded frequently in the both zones. Macroscopic charcoal influx increased progressively in zone I. Based on these fossil records and spatial patterns of forest vegetation in the present, during the mid to late Holocene, Q. semecarpifolia and P. wallichiana predominated in the forests mainly on the south-facing slopes, whereas especially on the north-facing slopes evergreen conifer forests consisting of Abies and Picea with Betula were established. The decline of Q. semecarpifolia and dominance of P. wallichiana in zone I may have been caused by changes in fire regimes associated with combined effects of climate changes and intensified land-use activities around the lake.

Keywords: fire regime, Holocene, Lake Rara, plant remains, pollen, vegetation

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HQR023-04 Room:303 Time:May 24 17:15-17:30

Plant fossil assemblages of the Last Glacial Maximum at Nakazato, northern Kanto region

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Valley-fill deposits were cropped out at Nakazato site, NW of Utsunomiya city, northern Kanto region. Peat and tephra deposits filled the valley, and the peat deposits are overlane by Shichihonzakura and Imaichi tephras of 13˜14 ka. Around the middle horizon of the thick peat, Ogawa Scoria is intercalated, which was derived from Nikko volcanoes a little after AT(29 ka). Therfore this peat is inferred to have piled up in LGM. There are very few studies of plant fossil assemblages in LGM not only in the northern Kanto but also whole Kanto region. Therefore, reconstruction of vegetation based on pollen analysis and plant macrofossil research at Nakazato site is very significant.

The plant macrofossil assemblages showed a typical assemblage in the last glacial as *Picea*, *Tsuga*, *Abies* includes *Abies veitchii* and *Betula*. *Picea* and *Betula* fossil pollen were detected abundantly from the peat horizon overlying Ogawa Scoria.

The reconstructed vegetation in LGM at Nakazato site is discussed in comparison with the plant fossil assemblages and paleoenvironments in LGM from other sites in Kanto and the middle part of Honshu.

Geological survey and sampling in Nakazato site were supported by the Research Group of Nakazatohara Outcrop(Yoichi Nakamura).

Keywords: pollen analysis, plant macrofossil, The Last Glacial Maximum, northern Kanto region

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HQR023-05 Room:303 Time:May 24 17:30-17:45

Depositional environment change during glacial/interglacial cycle, based on fluvial terraces, around Lake Biwa

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I clarified landform development around Lake Biwa based on geomorphological and geological survey. Although the lake level is controlled mainly by bedrock exposed along the course of the Seta River and not directly influenced by sea level, older to younger terraces are widely distributed. I interpreted that the formation and preservation of fluvial terraces were results of crustal movement and depositional environment changes during glacial/interglacial cycle.

Keywords: Lake Biwa, fluvial terrace, depositional environment, landform development, tephrochronology

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HQR023-06 Room:303 Time:May 24 17:45-18:00

Distribution and chronology of buried terraces in the Arakawa and Menuma Lowland and correlation with surrounding rivers

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Distribution of basal topography of the latest Pleistocene-Holocene incised valley fill (the Alluvium) was revealed based on analysis of more than three thousand borehole data and boring core samples in the middle and upper part of the Arakawa Lowland and the Menuma Lowland, central Kanto Plain (Ishihara *et al*., submitted a,b). We will discuss the forming processes of the basal topography of the lowland and their correlation with those in the Tokyo Lowland, and other alluvial lowlands such as Naka, Tama, Obitsu, and Yoro River lowland.

The basal topography beneath the Arakawa lowland can be divided into five buried landform surfaces: buried fluvial terrace surface I (S-I) to IV and incised valley bottom (S-V) which basal gravel (BG) of the Alluvium at the bottom. S-I to S-IV are widely distributed in the Arakawa Lowland, whereas their distribution are less clear in the Menuma Lowland. S-V ranges from the Arakawa Lowland to the Menuma Lowland and extending to the western bank of the current Tone River. S-I, II, III are partly coverd by the Kanto loam and As-YP tephra was found in the Kanto loam of S-III.

Six buried landform surfaces are identified in the lower part of the Arakawa Lowland and Tokyo Lowland (Matsuda, 1974; Ando and Watanabe, 1996): buried terrace surface Ar0, T_0, Ar1 (T_1), Ar2 (T_2), T_3, incised valley Ar3 (T_4), in descending order. S-I, II, III, IV, and V are correlated with surface Ar0, Ar1 (T_1), Ar2 (T_2), T_3, and Ar3 (T_4), respectively. Considering above correlation and recognition of As-YP from S-III, S-I can be correlated with the Musashino terrace surface, and S-II to S-IV are correlated with the Tachikawa terrace surface group. In the Arakawa and Menuma Lowland, the buried terrace surfaces can be recognized up to 65 km upstream from the present river mouth and the incised valley can be recognized up to 85 km upstream indicating that the influence of sea-level drop in the Last Glacial extended far inland in the central Kanto Plain, resulting in formation of several fluvial terrace surfaces.

Buried Tachikawa terrace group and incised valleys are also identified in Nakagawa, Tamagawa, Obitsugawa, Yorogawa, and other alluvial lowlands in the Kanto Plain (Kaizuka *et al*., 1977; Kashima, 1982; Endo *et al*., 1983). Correlation of basal topography of the Alluvium between in the Arakawa and Menuma Lowland, and in above other alluvial lowland, is discussed.

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Keywords: the Arakawa Lowland, the Menuma Lowland, buried terraces, the Last Glacial

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HQR023-07 Room:303 Time:May 24 18:00-18:15

Late Holocene environmental change in alluvial lowlands around the Lake Hamana, central Japan

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Lake Hamana is a brackish lake located on the Pacific coast of central Japan, facing the Nankai Trough. It covers ˜65.0 km^2 and is connected to the Pacific via a single channel between the sand bars. The lake has a complicated coast line with many alluvial lowlands, which were originally created as drowned valleys incising the Pleistocene terraces through the Holocene transgression and have progressively buried by sediments from the rivers and resulted in a fresh water marsh. This environmental change is closely related to both of the Holocene sea-level change and crustal movements(Ikeya *et al*. 1990). We carried out coring survey at coastal lowlands of the lake, and reconstructed their environmental changes since the middle Holocene using the depositional facies, diatom assemblages and radiocarbon ages.

Rokken-gawa lowland is located at southeastern coast of the lake. Surface geology of this lowland consists of mud layer, peat layer and sand layer in ascending order. The peat layer is divided into the upper and the lower parts by the mud layer identified between them. Sato *et al*. (2010) has pointed out that environmental changes from fresh water to brackish water condition occurred at ca.5500 calBP and ca. 3400 calBP respectively in this lowland. Here we discuss the environmental change of this lowland with additional data of sediment cores. The mud layer, above and beneath the lower part of the peat layer, shows dominance of brackish-marine species, for example *Cyclotella striata*, *Cocconeis scutellum* and so on. We also recognized at an elevation of -3.0 to -4.5 m in the mud layer, *Staurosira construens*, fresh-brackish water species, increased abruptly to be dominant. On the contrary, in the peat layer, fresh water species are dominant, for example *Tabellaria fenestrate*, *Aulacoseira* spp. and *Pinnularia* spp. These data indicate that water salinity decreased three times since the middle Holocene in this lowland. Radiocarbons ages by Sato *et al*. (2010) suggest that these events have occurred around 3400 calBP, 5500 calBP and before 5500 calBP.

In Shinjo lowland, located at southwestern coast of the lake, surface geology consists of mud layer, peat layer and sand layer in ascending order. The peat layer is subdivided into three parts by mud layer. We obtained new radiocarbon ages from each of these parts: 6420-6640 calBP (at the basis of the lower part), 4970-5300 calBP (in the middle part) and 5640-5900 calBP (at the basis of the upper part). The main components of diatom species in the mud layer are brackish-marine species, for example *Cyclotella striata*, *Cocconeis scutellum* and *Achnanthes submarina*. On the other hand, the peat layer shows abundance of fresh water species and dominance of *Staurosira construens*. These data imply that water salinity decreased three times in this lowland. On the basis of the radiocarbon ages, we infer that these events occurred around 6500 calBP, 5700 calBP and 5100 calBP, respectively.

According to the above data, synchronic occurrence of water salinity decreasing event is recognized between the two lowlands around 6500-5000 calBP. This period is also synchronous with the enclosure of bay by sand bars estimated from foraminiferal assemblages taken from lake bed sediments (Matsubara 2001). This suggests that environmental change at the two lowlands was also caused by the development of the sand bars sheltering the lake from the Pacific to decrease the seawater influx to Lake Hamana. Lake water salinity around 6500-5000 calBP is fluctuated drastically in short period. This indicates the formations and collapses of the sand bars occurred repeatedly.

Reference

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Sato Y. *et al*. 2010. JGU, HQR010-P25.(English abstract)

Keywords: environmental change, sand bar, diatom assemblages, Lake Hamana, Holocene

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HQR023-08 Room:303 Time:May 24 18:15-18:30

Use of electrical conductivity of Holocene deposits in the Nobi plain to analyze depositional environment

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Electrical conductivity (EC) method is simple approach for estimation of depositional environment. Naruhashi et al (2010) indicates the possibility that EC records rapid changes of depositional environment in inner bay floor, on the basis of rapid increasing and decreasing of EC through the faulting event horizons on the Kuwana fault.

In this study, the usefulness of EC of stirred Holocene deltaic sediments from three cores from the Nobi Plain, Japan, was assessed as a proxy for marine transgression and regression. At first, the influence of grain size on EC was evaluated, because for same salinity, finer sediments tend to show higher EC (Yokoyama and Sato 1987). Lack of correlation of EC with mud content for the sediments with >20% mud suggested that permeability was a negligible factor, based on the correlation of mud content to permeability. Then, EC was compared with facies analysis results and the ratios of marine diatom specie. Marine deposits showed high EC (>0.9 mS/cm), terrestrial deposits low EC (<0.4 mS/cm), and brackish deposits intermediate. Because it was positively correlated with the percentage of marine diatom species, EC in inner bay deposits primarily reflected salinity. In the YM core (the youngest of the three cores), EC of the inner bay deposits was weakly positively correlated with clay content, which controls pore water content. EC of inner bay clayey deposits was generally higher in YM than in KZN, suggesting that the lower EC in older clayey sediments results from compaction. These findings suggest that the EC values of fine sediments initially record salinity but may decrease gradually over time under the influence of compaction. Thus, to reconstruct the original salinity, the effects of compaction and of grain size distribution?and especially clay content?should be evaluated.

Keywords: salinity, Holocene, depositional environment, electrical conductivity, Nobi plain

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HQR023-09 Room:303 Time:May 25 08:30-08:45

Floodplain evolution in lower reach of the Stung Sen River, central Cambodia

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The Stung Sen River which has the largest drainage basin in the Tonle Sap water system flows in an arc at central Cambodia region. At 230 km upstream from the Lake Tonle Sap, the river flows across a 7-km-wide floodplain and water level of the river changes 7 m annually because of two distinct seasons driven by monsoon. This research considers floodplain evolution of the Stung Sen River based on characteristics of the drilled cores in the floodplain and outcrops along the river in dry season, and ^{14}C datings.

The channel of lower river is about 6-7 m depth and 70-100 m width with a rectangular cross section, which forms prominent meander scrolls along the channel. Although abandoned channels are well developed along the channel, natural levees are poorly formed and ground elevation decreases toward the channel. In addition, the floodplain is surrounded by uplands, so that flood water in monsoon season easily flows into floodplain and becomes remarkably wet especially along the channel. In floodplain, channel deposits of gravel to medium sand and back marsh deposits of silt to clay are accumulated at least 10 m on the basement of floodplain deposits. The channel deposits become thicker as it approaches to the channel, and the particle size becomes larger. ^{14}C ages of channel deposits are comparatively new along the channel. In meander belt, which is composed of the channel, meander scrolls and abandoned channels, channel shifts and change of the deposits are prominent in particular, and that probably occurs in several decades order. ^{14}C ages of back marsh deposits suggest to have been accumulated during last 35000 years by the accumulation rate of 0.1 -0.6 mm/yr with occasional channel deposits. This may suggest that the depositional pattern in the edge of floodplain has not drastically changed since the latest Pleistocene. Moreover, the oxidative-reductive reddish patches of the deposits which are highly recognized near the channel show the situation that the groundwater level alternates by monsoon.

Keywords: Stung Sen River, meander, boring core, ^{14}C age, Cambodia

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HQR023-10 Room:303 Time:May 25 08:45-09:00

Relationship between slope collapse and landform evolution of active fold zone

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Large earthquakes occurred in Chuetsu District, such as the 2004 Niigata Prefecture Chuetsu Earthquake and the 2007 Niigata Prefecture Chuetsu-oki Earthquake. There are many active folds in Chuetsu District, and about 10cm uplift of Oginojo Anticline by the Chuetsu-oki Earthquake was detected by InSAR, and several slope collapses occurred in Nishiyama Hills. However, 0.5-1m uplift by the Chuetsu Earthquake was detected by difference between the DEM measured by photogrammetry using aerial photos taken before earthquake and the DEM by airborne laser survey measured after earthquake, and many slope collapses and landslides by earthquake are concentrated in Imokawa-River region. The authors try to survey the relationship between the growth of active fold by earthquake and the concentration of slope collapses by earthquake.

There is no terrace which is older than 15ka along Imokawa-River, because uplifting ratio of Imokawa-River region is large. As the relative elevation between oldest terrace and river bed is 20m in downstream and 30m in upstream, uplift ratio is 1.3-2 mm/year. If amount of uplift of the Chuetsu Earthquake is about 1m, the cycle of one earthquake would be 500-770 years. This research is supported by Grants in Aid for Scientific Research (22500994).

Keywords: active fold, slope collapse, Chuetsu Earthquake, Chuetsu-oki Earthquake, Imokawa River, Nishiyama Hills

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HQR023-11 Room:303 Time:May 25 09:00-09:15

Late Quaternary Tephrostratigraphy of Marine Cores off Joetsu, Japan

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The piston cores and gravity cores from off Joetsu in the southeast Japan Sea contain widespread tephras from distal volcanoes in the Kyushu, Chugoku, Chubu, and Hokkaido area. Identification of these tephras is based on the mineral composition, and the morphologic feature and chemical composition of volcanic glass shards.

Since the Joetsu offing is located near the center of the Japanese islands, the place is advantageous in a tephra study geographically. In addition, sedimentation rate in this area is faster than in the other spots of Japan Sea because this area is near the shore. This means that this area has potential to reconstruct paleoenvironment with high resolution. MD179-3312 core with the length of about 32 m is the main target of this study, and the recovery of the core is regarded as 100%.

On the basis of the stratigraphy, petrography, and chemical composition of volcanic glass shards measured by microprobe analyzer (SEM-EDS; JEOL JSM-6390LA), tephras can be correlated to the As-K, Jo-2, AT, On-Ng, Aso-4, On-Kt, K-Tz, SK, Toya in descending order. As-K, AT, Aso-4, On-Kt, K-Tz, SK have been already found around the Sado Island, and the source of supply volcano has been known (Machida and Arai, 2003). Fernando(2010) finds two marker tephras of Jo-1 (Joetsu 1 tephra) and Jo-2, and former of which we compared with As-K. We discovered On-Ng and Toya at around this area for the first time. Furthermore, the tephra found in the lower of Toya through this project is correlative to Hikage-2 (HK-2: Nagahashi et al., 2007), although SiO2 of the volcanic glass is slightly lower than that of HK-2. There are some drift pumices (diameters are about 2-4mm) which might be correlative to On-Pm1 between K-Tz and SK based on its stratigraphic position. But it deviates from chemical composition of volcanic glass of On-Pm1.

This study expanded the isopachs of On-Ng and Toya. If the correlation between lower tephra of Toya and HK-2 is true, it indicates at least one of the eruption ages of Toya (113-114ka: Ganzawa et al., 2007) or HK-2 (105.9ka: Nagahashi et al., 2007) should be revised. In addition, If the drift pumices above can be correlated with On-Pm1, it means the Pm1 pumices were transported by Jinzu River and drifted in the Japan Sea.

Acknowledgements
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Keywords: Tephra, Japan Sea, Chronology, Late Pleistocene, MD179, SEM-EDS

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HQR023-12 Room:303 Time:May 25 09:15-09:30

Local marine radiocarbon age offset of Hokkaido region

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The natural radioisotope 129I dating covers an important age range for geological samples.The iodine contains 129I that is the long half-life radionuclide besides stable isotope 127I. 129I is a cosmogenic nuclide generated by cosmic rays in the atmosphere.It is possible to measure it by using 129I 127I at the iodine age. It is possible to measure iodine dating by using this equilibrium. However, present 129I/127I ratio is very high. Because a large amount 129I was added by the human act of using nuclear power. Therefore, it is indispensable to know initial 129I/127I ratio that doesn’t contain anthropogene 129I to measure 129I age.

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HQR023-13 Room:303 Time:May 25 09:30-09:45

14C analyses of sedimentation periods for shell middens at Higashimyo site, Saga prefecture

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The Higashimyo archeological site is located in huge Saga Plain, the largest in western Japan, at the northern end of Saga city, in Northern part of Kyushu. The Saga plain faces southwards the innermost part of Ariake bay, a bay of 15 km wide and 90 km long with relatively shallow water depths. A huge volume of shell fragments were accumulated at the Higashimyo site, and the most impressive archeological interest is that more than 400 of baskets knitted with twisted ropes made of thinly sliced wood were recovered. The knitted wooden baskets excavated here are the oldest (ca. 7800-7900 cal BP) recorded in the earliest Jomon period in Japan.

Six shell middens were detected at the Higashimyo site, and No.1 and No.2 middens were intensively excavated. For the No.1 midden, thickness of the mound was ca. 1.2m and the elevation of the uppermost layer was -1.1m, and for the No.2, the respective values were 1.5m and -0.5m. The starting and ending layers and several layers in between at No.1 and No.2 middens were 14C dated to estimate the duration period of the shell mound. We have collected shell fragments and terrestrial plant remains from the full layers, from the bottom to the top, of the two middens for 14C dating, to estimate the duration necessary to make up the total volume of the middens. Geographically it was certain that the middens had been formed during the sea-level-rising period a few thousand years after the start of Holocene.

The followings are revealed concerning the chronology of the Higashimyo site.

(1) According to 14C ages for terrestrial nuts for No.1 and No.2 middens, the sedimentation started almost the same time at around 8000 to 7850 cal BP for both middens. The termination time of accumulating shell fragments was, however, different. The No.1 shell middens stopped accumulation at 7950-7850 cal BP, and the No.2 did at 7800-7700 cal BP.

(2) Both terrestrial plants and marine shells were dated for both middens. 14C ages for the terrestrial plants are younger than those for the marine shells, by about 300-350 years. This apparent age difference is from the ocean reservoir effect. However, since the age difference is not established yet firmly (Nakamura et al. 2007), we adopted 0 years as the local reservoir correction value for the ocean reservoir effects, for further analysis.

(3) Our estimates yielded relatively shorter duration periods, i.e., 50-150 years and 150-250 years for the No.1 and No.2 middens, respectively.

Keywords: 14C age, Jomon shell midden, archeological site, sedimentation period, Jomon transgression, ocean reservoir effect

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HQR023-14 Room:303 Time:May 25 09:45-10:00

Upper Palaeolithic obsidian exploitation along the Shinano river in central north Japan

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Present paper focuses on the formulating interpretative models for acquisition and transportation of lithic raw materials, with reference to obsidian and siliceous hard shale, choosing a case of Upper Palaeolithic camp site Mattobara in central-north Japan. The site is located on the left bank of the latest Pleistocene river terrace in the middle course of the Shinano River, dated back ca. 17 ? 14ka from the date of similar assemblages and the dating of tephra in a neighboring areas. The lithic assemblage of this site is rather simple and small Points are significant. Excavations uncovered totally 8,200 lithic tools, flakes, and chips. Dominant raw material is siliceous hard shale, and it takes about 80percent of total lithic materials. Small scale concentrations of this site are representing the activities of small mobile-groups along the Shinano River in the later period of Late Pleistocene. Source identification of obsidian form Mattobara Loc. C by X-ray fluorescence analysis identified that thirty samples are from Wada-Pass, and one is form Kirigamine both located in Nagano Prefecture. On the contrary to the case of Loc. C, 24samples are from north Fukaura (Aomori Pref.) and Oga (Akita Pref.) and only one sample identified as Tadeshina (Nagano Pref.) in the case of Loc. A. These quite different and wide range available areas indicate a complex system of lithic raw materials. Linear linkage of stepping-stone model will be discussed, irrespective of long distant direct procurement /or nearby direct procurement (so called embedded strategy).

Keywords: Uper Paleolithic, Shinano river system, Obsidian, Geologic source identification, Matobara site, Point tool industry

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

HQR023-15 Room:303 Time:May 25 10:00-10:15

Holocene environmental evolution based on lake deposits in Central Eurasia

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To reconstruct environmental evolution in Ili Delta and Balkhash Lake areas, we have continued geological, geomorphological and paleoenvironmental researches under the Ili project, RIHN, since 2007 (Endo et aal., 2010) . Following the reconstruction of lake level change in the last 2000 years using 2007 core in the western part of Balkhash Lake, we took several cores in 2009 in the easternmost part of the lake, where is the deepest part of the lake.

These 2009 cores, covering almost Holocene, have been analyzed using pollen, diatom, and ostracod, and also geochemistry and magnetic properties. Two cores, 0901 and 0902, provide us continuous environmental records, which are combined with geological and geomorphological events and evidences.

Especially, in mid Holocene, highly lowered lake level stage is recognized from 5500 to 3500 years ago, when dry vegetation like desert was dominant and coniferous forest decreased. It suggests warm and dry climate is dominated.

In the lowest reaches of Heihe, the middle Inner Mongolian, about 20 paleoshore- lines (gravel bars) were dated by AMS 14C method. However, from 6000 to 3500 years BP there are no gravel bars, suggesting very low lake level dominant. After 3500 years BP, alluvial processes were reactivated and lake level attained to the highest (Endo et al.,2006).

Nearly same situation is reported in Mongolian lake, where 5800 to 3100 years BP, warm and dry conditions were dominant using diatom and pollen analyses (Wang et al.,2011). They proposed the existence of mid Holocene drought probably in east and central Asia.

We will compare the paleoenvironmental results in Central Eurasia with those of the eastern part during the middle Holocene, and discuss the extension of warm and dry climate, and the cause of such climate change.

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Keywords: lake level change, Holocene, hyper arid stage, pollen analysis, ostracod analysis, diatom analysis

Japan Geoscience Union Meeting 2011
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HQR023-16 Room:303 Time:May 25 10:15-10:30

Late Holocene fluvial landform development in the middle basin of Ili River, Kazakhstan

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Ili River runs from Tien-Sian Mountain as a source and flows into Balkhash Lake in the central Kazakhstan, Central Asia. The basin of Ili River belongs in the semi-arid area, and from the middle basin to the downstream basin is large plain called Ili Delta and observed paleo-channel clearly. Near Bakanas, modern channel run to the west, meanwhile paleo-channel run to the north. This means avulsion occurred.

About environmental change in Balkhash Lake, water level change past 2000 years is getting reconstructed for diatom and chemical analyses of drilling core (Endo et al.,2010; Chiba et al.,2010; Sugai et al.,2010 etc.). Shimizu and Sugai (2010) tried to reconstruct paleo-discharge of Ili River from the meander wavelength of Ili River course.

Since the 80 percent of influent water of Balkhash Lake is from the water of Ili River, To reveal the process and chronology of fluvial landforms in the middle and downstream part of Ili River will be useful for not only the key of clarification of landform development but also the key of environmental change in Balkhash Lake.

Fluvial landforms of Ili River including its paleo-channels were classified by field survey in August 2010 and interpretation of satellite images by google earth and DEM data from SRTM3.

The paleo-channels and fluvial surfaces were dated by AMS-14C method for the materials in the same fluvial sediment layer obtained through trenching survey. Particle analysis and magnetic susceptibility were also examined.

Fluvial landform along the middle part of Ili River was classified into five surfaces from T1 to T5.

T1 is the oldest, probably Pleistocene terrace covered with vegetated dune sand. At least, two cycles of upper-fining fluvial sediment units consist of T1. T2 is distributed along paleo-channel turning to the north at Bakbakthy. Aeolian sand dune partly covers T2. The paleo-channel is buried at least 30cm with fine aeolian sand.

T3 has paleo-channels whose meander length is larger than that of present channel. This implies that paleo discharge of T3 stage was larger than present discharge (Shimizu and Sugai, 2010). Two radiocarbon ages were obtained. One is about 1500 years ago from shell in sorted sand; the other is about 700 years ago from humic soil showing that the channel changed back marsh. That is to say, about 1500 years ago, the main channel of Ili River was forming T3, and after 700 years ago, this channel was abandoned and T3 became terrace.

T4 is distributed along the main stream of modern Ili River and formed after the main channel of Ili River moved to the west. Large flood is likely to flow into paleo-channels on T4.

T5 is the small floodplain of modern channel of Ili River and along the channel.

Fluvial landform development in the middle part of Ili River basin can be summarized as follows .

At first, Ili River ran on T2. Before 1500 years ago, an avlusion occurred in Ili River and T3 started forming. In this period, Ili River had large discharge and sediment. After T3 formed, Ili River channel sifted to west after 700 years ago, and T3 became terrace and T4 started forming. Today, T4 became terrace, and T5 is forming.

Reference

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Keywords: avlusion, 14C dating, paleo-channel, land classification

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

HQR023-17 Room:303 Time:May 25 10:45-11:00

Holocene environment changes in Lake Balkhash reconstructed by high-resolution XRF-core analysis and geomorphic survey

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Lake Balkhash is the largest terminal lake in central Asia. The lake sediment provides us to reconstruct climate changes during the Holocene. We obtained several sediment cores with a length of 5-6 m in the eastern part of the lake in 2009 under the Ili project, RIHN. This paper reports Holocene depositional environment changes in and around the eastern part of the lake based on high resolution (0.1 mm) XRF analysis of the longest two cores named as 901and 902 coupled with the analysis of the Lepsy river deposits. Site 901 is about 20 km distant from the present Lepsy river mouth, while site 902 is 40 km, where is the heart of the eastern part of the lake and its deepest point. The lake bottom topography between proximal site 901 and distal site 902 is almost flat with a water depth of about 20 m. In contrast average slope gradient between 901 site and Lepsy river mouth is about 1/1000, almost equal to the slope of the lower reaches of the Lepsy river bed. For detail near the river mouth, the slope of delta plain is gentler and the slope of the delta front slope is steeper than 1/1000. Under such geomorphic conditions, water-level fall and rise cause quick incision and accumulation of the river channel.

Lepsy river valley had been filled with fine and partly organic sediments with a thickness of several meters from the early Holocene to 5500 years ago. Then, dominant process changed from accumulation to incision. River terraces were formed and well-sorted sandy sediments were transported downstream. At around 2000 years ago, the river turned to accumulation phase again. The river bed and river terrace sediments contain SiO2 of 40-60% and CaO of 15-20%, while Fe2O3, MnO, and Al2O3 of less than 10 %.

Both 901 and 902 cores can be divided into three sedimentary units, the top and bottom units are whitish clayey sediments with high Ca content, indicating lots of calcium carbonates which include calcite, aragonite, and dolomite according to XRD analysis (Montani et al, 2011). The middle units deposited from 6000 to 3000 years ago based on AMS -14C dating and showed various kinds of stratified sedimentary structures including sand beds with plant fragments and gastropod fossils, parallel silty lamina (observed only in 901 core) and evaporites (in 902 core). The middle unit contains high SiO2 indicating siliceous deposits driven by Lepsy river.

Using high resolution cps values (near 30,000 points in total with vertical interval of 0.2 mm for each core) of major elements (Si, Ca, Mg, K, Fe, S, Al, etc) provided by micro-XRF analyzer, we calculated Ca / Si ratio to know the change of relative abundance of chemogenic (and partly biogenic) vs. terrigenous components of the sediments. Trend of Ca / Si ratio curves between the two cores were markedly concordant with each other and the ratio of distal core 902 was always larger than that of proximal core 901. This suggests that the lake-level fluctuations dominantly control the sedimentary environment; water level fall brings the river mouth close to the core sits and causes the river channel incision and terrace formation, resulting that chemogenic sediments are remarkably diluted by increase of terrigenous deposits at the core sites. Water level rise should bring the opposite results. At around 5500 years ago, when Ca / Si ratio showed the minimum (nearly zero), evaporites (gypsum and magnesite) deposited at site 902 and fluvial sand deposited at 901. This implies that the lake level dropped almost 20 m below the present level, and the river mouth reached 901 and playa appeared at the center of the eastern part of the Lake Balkhash.

Keywords: Lake Balkhash, kazakhstan, Holocene, chemical analysis, lake level change, Lepsy river

Japan Geoscience Union Meeting 2011
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HQR023-18 Room:303 Time:May 25 11:00-11:15

Reconstruction of past environment by an ice core drilled from Grigoriev ice cap in Kyrgyz Tienshan, Central Asia

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In 2007, ice cores were successfully drilled on Grigoriev Ice Cap located in the Tien Shan Mountains, Kyrgyztan. The elevation of the drilling site was 4600 m a.s.l. and entire core length was 87 m. We present stable isotope, mass balance, dust concentration, and pollen concentration in the last 200 years of the ice core.

Keywords: ice core, climate change, central asia, stable isotope, pollen

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HQR023-19 Room:303 Time:May 25 11:15-11:30

Climate reconstruction using hydrogen and oxygen isotope ratios of tree-ring cellulose in Kyrgyz

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Hydrogen and oxygen isotope chronologies of tree-ring cellulose were established to understand past climate variations in southwestern Kyrgyz. A total of three core samples collected in 1998 from three individual junipers growing in an arid region were subjected to hydrogen and oxygen isotopic analysis. One core sample was analyzed over the last 485 years at pentad (5-year) resolution by simply mixing 5 adjacent rings, while the remaining two cores were individually examined for the last 50 years at annual resolution.

Correlation coefficients between the two trees for the inter-annual variations during the 1948-97 period are 0.60 ($p<0.001$) and 0.30 ($p<0.05$), respectively, for hydrogen and oxygen isotopes, suggesting that isotopic ratios are at least partly controlled by common climatic factors. Response analysis with ambient climatic records revealed, however, that the hydrogen and oxygen chronologies did not show significant correlations with monthly temperatures and precipitation at annual resolution. On the other hand, the pentad isotope records compared with the corresponding instrumental data showed significant positive correlations with March-April and March-August temperatures, respectively, for hydrogen and oxygen isotope chronologies. These results indicate that the pentad-based measurements result in the smoothing of short-term and micro-scale environmental noises, such as heterogeneous spatial and temporal distributions of soil waters in the arid land, recorded in annually resolved chronologies.

The 485-year hydrogen isotope chronology, which reflects spring temperatures, shows multidecadal to century-scale fluctuations, with a notable warm period of ca. 1710-1730 and a warming trend over the 20th century. Interestingly, the warm anomalies of the early 1700s, which can be recognized at many other places in the world, correspond to the end of the Maunder Minimum (1645-1715), thus may indicate some causal relationship between them. The oxygen isotope data, which reflect temperatures in spring and summer seasons, show rough similarity in the high-frequency domain with the hydrogen isotope chronology, since oxygen and hydrogen isotopes of precipitation are highly correlated with each other. However, the long-term variations substantially differ from each other, indicating that different factors control isotopic ratios in the low-frequency domain. One important factor is relative humidity, to which oxygen isotopes are known to be sensitive rather than hydrogen isotopes. Though we were not able to compare the isotope records with relative humidity due to the lack of instrumental data, if we consider the effect of relative humidity, it is possible to explain the reason why oxygen isotopes showed the significant correlation with summer temperatures, which were not correlated with hydrogen isotopes, as follows. In the studied region, summer precipitation is much less than spring one, through which only spring temperatures can be recorded in tree-ring hydrogen isotopes. On the other hand, leaf water oxygen isotope enrichment occurs during photosynthesis in summer, controlled by the summer temperature through summer relative humidity. We therefore interpreted that the oxygen isotope chronology capture both of relative humidity in summer and temperatures in spring, and the divergence of long-term variations between the oxygen and hydrogen isotope chronologies originates from relative humidity. When the 485-year oxygen isotope chronology is assumed to be a proxy of relative humidity, it shows an arid condition during the 1750-1900 period, followed by a humid trend continuing up to present.

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HQR023-20 Room:303 Time:May 25 11:30-11:45

Fluctuation of glaciers and glacier runoff in Ili Basin during the last millennium

Akiko Sakai[1*], Chiyuki Narama[2], Nozomu Takeuchi[3], Koji Fujita[1], Jumpei Kubota[2]

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Ili River Basin is located at the Central Asia across from northwest China to Kazakhstan. A lot of mountain glaciers distributes at the northern Tien Shan Mountains in the Ili Basin. Meltwater from those glaciers flow through the Ili River and pour into the Balkhash Lake. Total glacier area attains only 0.7% of the total area of the basin. But, meltwater from glaciers is significant water resources because precipitation tends to increase with altitude. Furthermore, glacier can supply water during the summer dry season.

Hence, fluctuation of discharge from glaciers should have affect on the human activity in this basin. In this study, we have tried to reconstruct the fluctuations of glaciers and discharge from glaciers during the last millennium using proxy data such as tree ring and ice core record.

We will compare the calculated fluctuation of glacier area with glacier expansion record indicated by moraine dating in this presentation.

Keywords: glacier, discharge, proxy, tree ring, ice core

Japan Geoscience Union Meeting 2011
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HQR023-21 Room:303 Time:May 25 11:45-12:00

Water-level changes of Central Asian lakes during the last 1000 years based on historical maps

Chiyuki Narama[1*], Kicengge[1], Jumpei Kubota[1]

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To clarify the environmental changes in Central Asia during the past few hundred years, lake levels of three lakes, Aral Sea, Lake Issyk-Kul (Ysyk-kol), and Lake Balkhash in Central Asia were reconstructed by several historical maps and SRTM DEM data. These historical maps from the 17th-19th century were described in English, Russian, Mongolian, Manchu, Tibetan, Turkic, and Chinese languages during the Qing Dynasty for acquiring information about landscape and land-use of local people) in western countries. The maps show that water level of Aral Sea increased ˜2m in the mid-19th from 1960s before lake shrinkage. Water level of Lake Issyk-Kul was 14m higher than at the present during the 17th-mid-19th century, because lake water had overflowed to Chu river. Water level of Lake Balkhash increased 2-3m from the present during the 17th-mid-19th century. The maps show three lakes, which have the same water sources in the Pamirs and Tien Shan mountains, expanded in the 17th-19th century on the same timing. As the previous studies, Aral Sea experienced the drastic decline of the lake-level in the 12h-14th century, and the old settlements around Lake Issyk-Kul in the 10th-12th century have sunk under present lake level. According to several proxy data such as summer temperature from tree-rings, snow accumulation from ice-cores, glacier variations, soil development, and historical documents, this lake-level decline occurred in the 12th-14th century under dry period, and the increase of lake-level in the 17th-mid-19th century under the cold and wet conditions of the Little Ice Age. However, drastic decline of the Aral Sea lake-level might be related with water irrigation systems in the 7th-12th century around the Syr Darya and Amu Darya or flow changes of Amu Darya to Uzboi to the Caspian Sea as shown in previous studies. In specially, the water-level decline of Aral Sea was large-scale in the 12-14th century, comparing with the degree of water-level changes in three lakes during the Little Ice Age. These facts highlight the significant environmental changes including human impacts that have occurred in the past millennium in Central Asia.

Keywords: Central Asia, historical map, lake-level change, proxy data

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HQR023-22 Room:303 Time:May 25 12:00-12:15

Construction of hydrological model of the Ili River Basin

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The Ili River Basin is stretching over the China and Kazakhstan. It is an internal river that flows into the Balkhash Lake, which is the largest lake in the Central Asia. Its significant discharge comes from the Tian Shan ridge. Thus, elevation and precipitation difference in the basin is very large. Especially, from the middle part of the river to the lower part of the river, precipitation amount is drastically decreased, and there are classified as semi-arid and arid zone. Though traditional living form of this area was combination of nomadic grazing, and agriculture, large-scale developments such as electric power development by a dam construction and agricultural development during the period of the Soviet Union. In addition to this, under the condition of global warming, the amount of water supplied by glacier melting in the Tian Shan Mountain might decrease. Thus, to evaluate these anthropogenic impacts on hydrological cycle of the basin, we constructed a hydrological model of the basin.

Keywords: Ili, Balkhash lake, Kapchagai reservoir, irrigation

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HQR023-23 Room:303 Time:May 25 12:15-12:30

Climate change and historical interactions between human activities and the environment in Central Eurasia

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In this paper, a multi-disciplinary research project for understanding historical interactions between humans and the natural environment in arid to semi-arid Regions in Central Eurasia will be outlined.

Historically and geographically, Central Eurasia has been a key area of interaction, transit and exchange between East and West. While many Central Eurasian peoples are well recognized in historical records as skilled nomads, merchants and traders, it is more recently acknowledged that these peoples also assimilated the ideas and artifacts passing through their territories into their own cultures, often with material effect on landscapes and livelihoods. At the same time, Central Eurasia is an excellent location for tracing human reactions to both past climate changes and anthropogenic activities. In this climatically sensitive area, which alternates between semi-arid and arid conditions, human influence can be historically traced. The area with extended arid and semiarid deserts has potential agricultural plains along rivers, flowing from high mountains with many glaciers, which were actively cultivated far back in historical time. These border regions could record both natural environmental and anthropogenic changes very sensitively.

Although interactions between environmental changes and human reactions have rarely been studied in Central Eurasia, agricultural development in the Aral Sea basin has caused the severe lake-level regression that started in the 1960's. Recent agricultural development in arid to semi-arid regions, especially in the latter half of the 20th century associated with modern irrigation technology, has contributed to increasing agricultural production. However, considerable environmental issues have resulted. It is important, therefore, to balance resource development and preservation in arid and semi-arid regions.

This project aims to study and clarify the historical interaction between human activities and natural systems in the semi-arid region of Central Eurasia, The project attempts to clarify historical changes, the rise and fall of nomadic groups and countries, their removal, changes in subsistence, the use of natural resources, and climate change through the analysis of historical documents and archaeological investigations as well as various natural proxies such as ice cores, lake sediment samples, tree rings and wind-blown deposits. At the same time, we will investigate the present status of the area and the effects of human activities on the natural environment, with particular emphasis on their social, religious and cultural background.

Keywords: human societies, environment, historical interaction, arid regions, climate chnage

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HQR023-24 Room:303 Time:May 25 12:30-12:45

Diachronic dynamics of human-environment interactions in Eurasia

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General discussion and prospects of the Diachronic dynamics of human-environment interactions in Eurasia

Keywords: human-environment interactions, Eurasia, Quaternary, paleoclimate, paleoecology, naturtal environment