

APE031-01

Room:104

Time:May 25 14:15-14:30

Holocene sea surface temperature variability in the NW subarctic Pacific

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Multi-centennial to millennial scale climate variability during the Holocene is a key to understand the future climate change. However, the high-resolution Holocene records in the subarctic Pacific are limited. We conducted the Holocene sea surface temperature (SST) reconstruction in the NW subarctic Pacific using oxygen isotope of planktonic foraminifer and discussed about forcing mechanism of SST. High sedimentation rate of the sediment off Shimokita peninsula, approximately 70 cm/kyr, made it possible to reconstruct multi-centennial scale SST variability in the subarctic. The oxygen isotope was analyzed for two planktonic foraminiferal species, *Globigerina bulloides* and *Neogloboquadrina incompta*. Although isotope results showed offset of 1.4‰ between species, long-term trend and short-term variations of two records resembled each other. In order to discuss about multi centennial- to millennial-scale variation, the long-term variation was subtracted from isotope record. The result of spectrum analyses clearly indicated 460, 1000, 2500 yr periodicity in SST. These periodicities are different from observed at Kashima where strongly influenced by the Kuroshio, suggesting that mechanisms that control SST variations in subarctic and subtropical NW Pacific are different. The periodicity and phase of SST variation in the subarctic resembled that of the Siberian High variation deduced from ion concentration in the Greenland ice core. On the basis of modern observation, it is suggested that the decadal-scale SST variation at the west of Tsugaru Strait is closely related with strength of the Siberian High. Thus, we conclude that subarctic SST variation during the Holocene is controlled by millennial-scale variation in the polar atmospheric circulation.

Keywords: Holocene, sea surface temperature, planktonic foraminifer, subarctic NW Pacific

Japan Geoscience Union Meeting 2011

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

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APE031-02

Room:104

Time:May 25 14:30-14:45

Reconstruction of spatio-temporal change of marine reservoir values around the Japanese islands

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Marine reservoir values around the glacial-deglacial Japanese islands were discussed in this paper. Modern marine reservoir values in the subarctic water territory in the northern Japan is larger than those in the subtropical water territory at the southern Japan. Tephra-based marine reservoir reconstruction indicated that the southward migration of the subarctic surface water during the last glacial-deglacial time created the large reservoir value at off Tokai region, which was almost the same value at off Sanriku region. Two LGM ashes in the Japan Sea cores also give us the important information on the marine reservoir values in the glacial Japan Sea.

Keywords: paleoenvironment, radiocarbon dating, tephra, NW Pacific, LGM-last deglaciation

APE031-03

Room:104

Time:May 25 14:45-15:00

Impact of ice sheet change on the depth of Antarctic continental margin

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The growth and decay history of Antarctic ice sheet affected geographic formation process of Antarctic continent and the margin through the Cenozoic era. Generally the characteristics of geography around Antarctic continent are that the surface topography is rich for the undulations, and the coastal region is what is covered by ice shelf. Moreover, depth of the continental shelf of Antarctica is about 500-900 m, and there is the place that reaches 1,000m in some places. In particular, ocean floor of the continental shelf of Antarctica is considerably deep in comparison with that of the other sea areas in the world. On the other hand, the conventional geophysical observations suggest that the topography of the long wavelength of the current Antarctic continent is almost isostatic equilibrium. This implication means that the present Antarctic ice sheet as a surface load makes the Earth deform. So the reason why continental shelf of Antarctica is very deep would be that the whole Antarctic continent including the continental shelf subsided by existence of Antarctic ice sheet as a huge load on earth's surface in comparison with the other continental shelf in the world. However, very few quantitative evaluations have been reported on the relation between the depth of continental margin and Antarctic ice sheet. Various interpretations using the geographical features and geological data in land and the peripheral seabed and the numerical simulation is essential to consider the relations of ice sheet history and geographic evolution of Antarctica. Here, we show the quantitative differences of the continental depth between Antarctica and the other continent, and using the glacial isostatic adjustment (GIA) modelling, we estimate the effects of ice sheet loading on the depth distribution of the continental shelf around Antarctica.

Keywords: Antarctic ice sheet, continental margin, isostasy

Japan Geoscience Union Meeting 2011

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APE031-04

Room:104

Time:May 25 15:00-15:15

Constraints on the early Pleistocene eustatic sea level changes from the Japan shallow-marine sediment record

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Eustatic sea level change during Quaternary has been inferred from oxygen isotope records of foraminifera in deep-marine sediments, although these records are also influenced by regional temperature changes. Shallow-marine sediment records only provide constraints on the inferred early Pleistocene sea-level changes, because the age is beyond the range of dating of coral-terrace sequences by the U-Th method. The Omma Formation exposed on the Japan Sea coast of Japan consists of 19 depositional sequences that represent alluvial plain to offshore environments, and correlate with marine isotope stages 56 to 21.3 during 41-kyr glaciations and the following Mid-Pleistocene Climate Transition (MPT). The reconstructed water depth change, based on analyses of lithofacies and fossil records, shows the following constraints on the sea level changes during MIS 55 to 21: (1) the sea level was lowest at MIS 22, (2) the sea level at MIS 34 and 26 were lower than the other glacial stages except for MIS 22 and (3) the sea level at MIS 23 was lower than those of other interglacial stages.

Keywords: early Pleistocene, sea-level changes

APE031-05

Room:104

Time:May 25 15:15-15:30

Biomarkers and XRF data reveal Holocene changes in runoff and sea level rise

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Climate in Florida is characterized by a strong annual hydrological cycle, with wet summers and dry winters. Precipitation is regulated by, amongst others, annual shifts in the position of the Intertropical Convergence Zone (ITCZ). During the Northern Hemisphere summer, the ITCZ moves North of the equator thereby increasing transport of moist air into the Gulf of Mexico. Currently, also the El Nino Southern Oscillation (ENSO) affects precipitation in Florida, especially by increasing the amount of winter rainfall during an El Nino event. To study long term changes in the hydrological cycle of Florida, a paleoclimate reconstruction was made, of the past ~9000 years using sediments recovered from a shallow marine setting in southwest Florida (Charlotte Harbor). During this period, sea level rise has played a major role on the environmental changes in the estuary. A high resolution multi-proxy approach allows for the distinction between environmental change due to submergence and climate change. Whole core XRF scanning was used to reconstruct variations in quartz and carbonate content, which was used to correlate different sediment cores. Changes in runoff were reconstructed by looking at fluxes of terrestrial biomarkers, while primary productivity is based on aquatic biomarker fluxes. The BIT index (an index of Branched (terrestrial) versus Isoprenoidal (marine) Tetraethers [1]), and C/N ratios were used to estimate the relative input of terrestrial versus marine organic matter.

The lowest part of the sediment core consists of quartz sands and bivalves and was part of a tidal flat. Between 8500 and 7000 year BP, the site completely submerged, resulting in a restricted marine setting which lasted until about 3500 year BP. Between 6000 and 5000 years BP maxima in terrestrial biomarker fluxes indicate a maximum in runoff, likely due to enhanced rainfall. Reconstructions of runoff and precipitation in the Gulf of Mexico and Caribbean also indicate increased moist conditions during the mid Holocene [2] and increased moisture transport into the Gulf of Mexico between 6500 and 4500 years BP [3]. Warmer northern Hemisphere temperatures and, as a consequence of this, a more northward position of the ITCZ might have been responsible for this, because this would enhance easterly winds which are responsible for bringing moist air to the Gulf of Mexico. Up to 3500 year BP, BIT index and C/N ratio indicate a gradual increase in marine organic matter, indicating gradual submergence of Florida during the mid-Holocene.

From 3500 years BP onwards, the terrestrial input strongly decreased and organic proxies indicate a change towards relatively more marine conditions. Sea level rise is unlikely to have caused this change in environment, because submergence curves for Florida indicate decelerating rates towards the late Holocene [4]. Pollen reconstructions in a wetland in southwest Florida show a development from grass vegetation during the mid Holocene to a Cypress swamp forest in the late Holocene [5]. This is thought to be a consequence of an intensification of ENSO activity in the late Holocene, which resulted in more winter precipitation and longer growing seasons during an El Nino event. This development in vegetation would have increased the water retaining capacity of the soils and prevented erosion, which explains the observed decrease in terrestrial biomarkers. Over the last century, runoff increased again due to human activity, like deforestation and wetland drainage.

[1] Hopmans et al., 2004. *Earth Planet. Sci. Lett.* 224, 107-116

[2] Montero-Serrano et al., 2010. *Global Planet. Change.* 74, 132-143

[3] Poore et al., 2003. *Paleoceanography*, 18, 2, 1048

[4] Toscano and Macintyre, 2003. *Coral Reefs* 22, 257-270

[5] Donders et al., 2005. *PNAS* 102(31), 10904-10908

Keywords: Precipitation, Holocene, Florida, Biomarkers

Japan Geoscience Union Meeting 2011

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

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APE031-06

Room:104

Time:May 25 15:30-15:45

Environmental change at the Western Japan during the Jomon period and its effects on human activity

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The mid-Holocene is well known for its warmer climate than that of the present. The warm Holocene climate provided a good environment for people living in Japan. Interestingly, the population of the Eastern Japan was larger than that of the western Japan throughout the Jomon period. It was the Yayoi period that the population density of the western Japan and the Tohoku region had been reversed. It is important to assess the influence of environmental change on human activity at the Jomon sites, because we need to estimate the impacts of future global warming in Japan. Sediment cores were recovered from the southwestern Seto-Inland Sea (e.g., Hiroshima Bay) during the 2009 cruise KT09-14 of R/V Tansei-maru. In this study, I use the core H3 recovered from Hiroshima Bay for reconstruction of high resolution climatic and environmental change at the western Jomon sites. Our goal is to understand the relationship between environmental change and the rise and fall of the human population at the western Japan from the Jomon period to the Yayoi period. At the present moment, we carried out ¹⁴C-dating and estimated sedimentation rate of core H3. Furthermore we are reconstructing sea surface temperature (SST) based on relationship between SST and undersaturation of C³⁷ alkenone of prymnesiophyte coccolithophorides.

Keywords: Jomon sites, Western Japan, environmental change, 14C-dating, alkenone paleothermometer

APE031-07

Room:104

Time:May 25 15:45-16:00

Phytoplankton dynamics during the 20th century in Beppu Bay: effects of nutrient supply from land and shelf waters

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Anthropogenic activities during the 20th century have greatly increased the flux of nutrients to aquatic ecosystems worldwide, with an accelerating rate of increase. However, in recent years there have been signs of oligotrophication in some estuaries of developed countries due to an excess removal of nutrients from the discharged water of sewage treatment plants or the impoundment of rivers by dams. In the Seto Inland Sea, which plays a major role in coastal fishing part of Japan, after the progress of eutrophication the hasty reduction of phosphorus loading could have lowered the phytoplankton primary production and also caused a detrimental effect on the fishery production. On the other hand, the Seto Inland is also likely to be affected by the variation of Kuroshio Current axis. To establish an ecosystem management plan for a estuarine ecosystem, it is essential to understand how the phytoplankton community has been altered in response to these environmental changes. In this study, we examined diatom remains and fossil pigments in Beppu Bay sediment to reveal historical changes in the phytoplankton community structure over the past 100 years in the Seto Inland Sea, and identify environmental factors that caused such changes.

Sedimentary analysis showed that the abundance of phytoplankton in Beppu Bay drastically increased since the 1960s when the fluxes of TN and TP rapidly increased. Afterwards, that of phytoplankton decreased, but however again increased greatly in the early 1990s. These sedimentary records were almost consistent with the monitoring data of chlorophyll a in this bay, although monitoring data are sporadic. We report and discuss the causal factors driving the changes in phytoplankton community structure focused on the effects of nutrient loading from the watershed and year-to-year variation of Kuroshio axis.

Keywords: 20th century, the Seto Inland Sea, Kuroshio Current, eutrophication, paleoceanography, phytoplankton

APE031-08

Room:104

Time:May 25 16:00-16:15

Why is the D-O cycle-like-abrupt change frequently seen in the midway of Glacial cycle

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Millennial climate change such as D-O cycles, AIM recorded in ice cores in both Hemispheres is known to show a relatively higher amplitude in the middle-level of a glacial cycle than in the interglacial state or severe glacial state. Although massive discharge or melt water of Ice sheet to ocean is one of the cause thought to be responsible for the millennial climate change, the thermal response to fresh water release in North Atlantic in global models and/or the paleoclimatic data in the region far from North Atlantic do not agree and even do not explain the dependence of the amplitude upon the level of climate state. Here we ran several sensitivity experiments using a coupled atmosphere and ocean GCM (MIROC3 and 4) and Ice sheet model and show that (1) the response to fresh water release to the ocean and bipolar response is highly dependent on the background climate and (2) the ice sheet change in millennia time scale occurs only when the condition of insolation and ice sheet are under certain range of condition. The AOGCM experiments were conducted with 500 years water hosing of 0.05 to 0.1 Sv (where 1 Sv is equivalent to the water flux of 10m sea level rise in 100 years) in the North Atlantic 50-70N in the same manner and position as CMIP/PMIP protocol under different basic states; Modern Hosing under modern climate with the pre-industrial condition, Intermediate Glacial hosing under the condition with intermediate level of Greenhouse Gases, insolation, ice sheet and Glacial hosing under LGM condition (21ka as PMIP2). The results show largest cooling response in North Atlantic and a reasonable bipolar warming signal as in the ice cores of Antarctica, and the dependence upon background climate is not relatively the same for the both hemisphere. The favorable condition for the abrupt changes is discussed in terms of insolation, ice sheet size, sea ice extent and the melt water amount.

APE031-09

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Time:May 25 16:30-16:45

Message from lake sediments on environmental change

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Lake sediments are recognized as good recorders of a variety of temporal and spatial scales such as global climatic change, geological history, biological evolution, watershed disturbance and so on. Techniques on analyzing lake sediments recently have been progressing, and those are carried out from the viewpoint of multi-time scale for multipurpose relating with the environmental change. I introduce the history and present situation of the research on environmental change using the famous lacustrine record from Lake Biwa and Lake Suigetsu in central Japan. Lake Biwa is the largest and oldest lake in Japan. Whereas the neighbouring basin Lake Suigetsu has varved sediments of the past 150 kyr. Lake Biwa has continuous sediments of a million year age. Therefore coupling of the two basin works will permit understanding on the Quaternary climate and tectonics in multi time scale. Deep drilling for Lake Biwa commenced in the 1970's, and the drilled core in 1982-1983 (i.e., the 1400 m core) have revealed about 911 m sediments overlying the basement rocks. Recently, the doubt on discontinuity of the sequence in present Lake Biwa was completely cleared. Improvements on fission track timescale have successfully identified the paleomagnetic reversal near the base as Jarammillo rather than Olduvai, determining time coverage of the Lake Biwa sediment as ~1.3 Ma. A highly linear SAR (Sediment Accumulation Rate) curve is thus given to the 900 m-deep Lake Biwa sediment. This secures the stable sedimentary environment of the basin, and the significance of Lake Biwa sediment as a good recorder for paleoclimate changes. Moreover, progress in the Japanese tephrochronology in recent decades has provided marker tephtras in and around the basin. Lake Biwa is, therefore, an ideal terrestrial site to explore paleoclimate and tectonic history during the past 1 Ma of East Asia. Providing examples of paleomonsoon variations will improve our knowledge on the present monsoon drive mechanism by examining the interaction to the Earth's internal forcings. In 2007 and 2008, six piston cores and two long cores newly were obtained, and multidiscipline approaches of pollen, diatom, alkenone, inorganic geochemistry and paleomagnetic analyses realize the above research scopes, for contributing to the loading issues that the Japanese and world societies now highly concerns. Lake Suigetsu has been known to the Quaternary Science community for its annually-laminated (varved) sediment record that spans the last c.70 kyr using the four piston cores and a long core obtained from the center of Lake Suigetsu by Yasuda and co-workers (Takemura et al., 1994, Kitagawa et al., 1995, Yasuda et al., 2004). Kitagawa and van der Plicht (1998a; 1998b; 2000) established a high-precision independent chronology for the core through counting of the annual layers (varves). Nakagawa et al. (2003; 2005; 2006) published high-resolution pollen analysis and pollen-based quantitative climate reconstruction through the deglacial interval to the early Holocene section. In summer 2006, a research team conducted by Prof. Nakagawa obtained a new sediment core reaching the base of the sedimentary profile (73.19 m below the lake bottom). Cores were recovered from four parallel boreholes with fully overlapping core segments, and the precise analysis is now progressing.

Keywords: environmental change, lake sediments, Lake Biwa, Lake Suigetsu

APE031-10

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Time:May 25 16:45-17:00

Lake sediments as an unique evolutionary record of diatoms

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A 240-thousand-year morphological evolution of a diatom lineage is presented from investigation of Lake Biwa boring core called 200-m core. Tempo and mode of the evolution is examined from 245 subsamples, each of which represents several hundred years record of diatom population in the lake. Time interval of them distributes between 200 and 5000 years and the mean is about 1000 years. Such time resolution is the highest among researches dealing with morphological evolution. The results show continuous morphological change in a lineage which begins from *Stephanodiscus vestibulis* like species and ends with *S. suzukii* which is an extant endemic in Lake Biwa. During the transitional sequence, three times of directional change was occurred intermittently. The directional changes are occurred in 200-190, 160-150 and 130-120 ka and last within 10 thousand years, respectively. Stases stand for longer periods between the directional changes, which is characterized by unbiased random walk in valve morphology. The directional changes correspond with climatological transitions, from interglacial to glacial period, from warm phase to cold phase during glacial period and from glacial to interglacial period. These coincidences predict glacial-interglacial environmental changes drive the diatom evolution. However, any directional change was not observed after *S. suzukii* appeared in the last interglacial. Morphological variation in temporal population seems to decrease in this period. Further research should reveal more immediate cause and mechanism of the diatom evolution. Climate and environmental change in the Quaternary, especially in the last glacial and the Holocene has been well examined with combined proxies from sedimentology, mineralogy, geochemistry, and paleontology like pollen analysis. Comparing them with diatom evolution should promote understanding of evolutionary history of diatoms and its backgrounds.

Diatom fossils are not only an environmental proxy but also an exceptional example showing evolution in geological time scale. Lake sediments provides advantage for describing it with their high sedimentation rate and good preservation of diatom fossils. This is the first step to understand diatom which is the most successful unicellular algae which has increased its biomass and diversity throughout Cenozoic ecosystem. Quaternary glacial-interglacial cycles greatly affects on chemical and physical property of lakes and their global distribution. Essential aspects, such as ecology and evolution, are remaining in the studies on lake sediments deposited under these variable environments.

Keywords: lake sediment, diatom fossil, Quaternary, morphological evolution, biogeography

APE031-11

Room:104

Time:May 25 17:00-17:15

Anthropogenic changes of the eutrophied Lake Mokoto recorded in lake sediments in the east part of Hokkaido, Japan

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In the coastal area of the Sea of Okhotsk in the east part of Hokkaido located to for subarctic zone, many brackish-water lakes are distributed. Especially, the Okhotsk brackish-water lake group around Abashiri City is constituted by major lake in Japan such as Lake Abashiri, Lake Mokoto, Lake Tofutsu, and Lake Notoro. The each lake shows a different present environment and history. Therefore, the change that is common in those lakes seems to be the change concerning the climate. In this study, anthropogenic change in Lake Mokoto is discussed by sedimentologic and geochemical high-resolution analysis of the cores collected from Lake Mokoto.

Mokoto has two-layer structure of intermediate salinity surface waters and high salinity bottom water (below water depth 1m). The bottom water in Lake Mokoto shows the anoxic conditions in summer season.

The cores collected from Lake Mokoto shows the length of 1.78 to 3.87m. In Lake Mokoto, there was the Ta-a tephra (AD 1739) at the 3.5m depths.

The cores collected from Lake Mokoto consist of organic mud with the lamination in all cores. In 09Mk-1C core, the core top 100 cm shows the black (N1.5/0, L value: ca 5), and it seems to indicate the seasonal anoxic environment as present. The organic mud below 100cm depth shows black (10YR1.7/1, 2/1, L values: ca 15). In the observation by the soft X-ray photograph, the cyclic lamina set is observed in the core from Lake Mokoto. It is considered that this cyclic lamina set is the verge. According to the meteorological data in Abashiri region, the annually precipitation is high from August to September. Probably, the cyclic lamina set is formed by cyclic change of precipitation.

Phosphorus contents in 09Mk-1C core show the relatively high values (ca 0.1wt%) above 100cm depth. However, Phosphorus is not detected below this horizon. The increasing of phosphorus contents may be caused by drainage of pollution from stock farm. The horizon of phosphorus increasing is estimated to AD1957 from the number of cyclic lamina set. In report, domestic animal increased at AD1955 in the drainage basin. This timing is consistent with phosphorus increasing.

The thickness of lamina set is about 7mm before late 1960's for the age of cyclic lamina set. After that, the thickness of lamina set is about 25mm. It is suggest that Lake Mokoto is aggrading by sediment from drainage basin under high sedimentation rate.

Keywords: Lake Mokoto, lamina, Ta-a tephra, anoxic, phosphorus, sedimentation ratio

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Time:May 25 17:15-17:30

Holocene vegetation history and quantitative reconstruction of palaeoclimate using pollen profile from Lake Ogawara

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High-resolution climate records in terrestrial area provide important information about the mechanism of climate teleconnection via atmosphere and ocean circulation. Climate change during the Holocene was characterised by short-lived and small magnitude. Some geological evidence suggests that cooling in the early Holocene triggered by catastrophic release of fresh water stored in glacial Lake. In particular, the 8.2 ka cooling event seems to have had an immediate and large-scale impact throughout the North Atlantic region. However, high-resolution climate data are spares in the mid-latitudinal zones of western Pacific, to discuss the picture on the hemispheric scale.

The East Asian monsoon is one of the most important climatic boundaries in understanding the global climate teleconnection. The Pacific side of northeastern Japan, especially, is a suitable location for studying the East Asian monsoon, because this area is strongly influenced by the Siberian, Pacific, and Okhotsk high-pressure systems. Therefore, the palaeoclimate records at this region are expected to detect the strength of winter and summer East Asian monsoon.

As preliminary report, we present the results of low-resolution pollen profile from a continuous sediment cores at Lake Ogawara, northeastern Japan. We discuss vegetation changes and climate during the Holocene using pollen profile, in attempt to better understand past monsoon activity.

Keywords: pollen analysis, vegetation history, pollen-based climate reconstruction, Holocene, Lake Ogawara

APE031-13

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Time:May 25 17:30-17:45

Detection of invisible microtephra traces for Lake Ichi-no-Megata sediments using high-resolution major element analysis

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The volcanic ashes layer records correct time when a volcano erupted. Therefore it is very important that we detect tephra. Our purpose is to detect the tephra which we were able to detect with neither observation by the naked eye and magnetic susceptibility from the profile of the Na/Al ratio in core sediment from lake. In comparison with lake sediments, there is very much content of the sodium of volcanic glasses included in tephra. We can detect tephra from the profile of Na₂O/Al₂O₃ ratio. The analysis of inorganic chemical composition using ICP-AES and magnetic susceptibility performed on specimens of bulk sediments from a drilled core taken from lake Ichi-no-Megata in Akita prefecture. As a result, we clarified that there was To-a tephra from the profile of Na₂O/Al₂O₃ ratio. In this core, To-a tephra was invisible to the naked eye, and cannot detect using magnetic susceptibility. A value of the means of the Na/Al ratio in lake Ichi-no-Megata drilled core samples is 0.074±0.024(2sigma), and a value of the Na/Al ratio in volcanic glass included in To-a tephra is 0.31. If volcanic glass included in To-a tephra in this drilled core samples is included more than 9% on the basis of density, we can detect To-a tephra. The value of the Na/Al ratio of lake Ichi-no-Megata drilled core samples and the value of Na/Al ratio of North American shale composite (NASC) and Post-Archean Australian average Shale (PAAS) known for average composition of continental crust show a very near value.

Therefore we can adapt ourselves to the area except Japan if we have the value of the Na₂O/Al₂O₃ ratio at the same level as Japanese tephra.

Keywords: microtephra, Lake Ichi-no-Megata

Japan Geoscience Union Meeting 2011

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

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APE031-14

Room:104

Time:May 25 17:45-18:00

Application of dendrochronological dating for varved lake sediments from Lake Fukami, Central Japan

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Various archives such as tree rings, varves, ice cores and historical documents have provided effective proxy data for unraveling the past environmental variability. The archives have provided valuable insight into the past environmental conditions by assigning accurate calendar dates. Dendrochronology is the science of dating tree rings, widely used to address environmental and historical issues. Tree-ring dating, so called crossdating, is performed by cross-matching variations in ring characteristics among tree-ring series. This procedure can determine the exact calendar year of each tree ring. In this study, we attempted to date varved lake sediment of twelve cores annually, recovered from Lake Fukami in Central Japan by using the dendrochronological crossdating.

APE031-15

Room:104

Time:May 25 18:00-18:15

Variability of diatom productivity and its control mechanism in the Late Pleistocene Takano Formation, Japan

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A 54-m-long lacustrine sediment core was taken from the Late Pleistocene Takano Formation, southern Nagano City, Japan in 2004. This sediment consists of homogeneous clayey silt with many tephra beds. Paleoclimate has been reconstructed by total organic carbon and nitrogen contents (Tawara et al. 2006; Kumon and Tawara 2009). This study provides the insights into the past diatom productivity and its control mechanism from the major elements and lamina preservation degree.

This sediment covers from 160 to 30 ka on the basis of the tephrochronology using the four tephtras such as Aso-2, -3, -4, and BW1466 (Nagahashi et al. 2007). The temporary resolution of this study is between 100 and 300 years.

$\text{SiO}_2/\text{Al}_2\text{O}_3$ ratio of this sediment can be regarded as a proxy of diatom productivity, because of having correlation between $\text{SiO}_2/\text{Al}_2\text{O}_3$ ratio and biogenic silica content (Ito et al. 2010). The periods showing high diatom productivity are correspond that having high lamina preservation degree. Moreover, lamina preservation degree shows high during the periods having high $\text{Fe}_2\text{O}_3/\text{Al}_2\text{O}_3$ ratio, which has significant correlation with siderite content in the sediments. Because siderite can be formed under anoxic environment, the lamina preservation degree can be regarded as the proxy of the anoxic environments in the lake floor.

Diatom productivity shows similar variation with relative climate change in this region reconstructed by pollen assemblage. This fact indicates the local climate change controls diatom productivity.

According to the above results, the control mechanism of diatom productivity can be considered as follows. Local climate change leads to change of lake circulation patterns, and subsequently it affects the oxygenation degree in the lake floor, which controls nutrients supply to the photic zone in which diatom productivity supports during the seasonal overturn periods.

Diatom productivity variation has 20-kyr periodicity as orbital-scale, thus it seems to be controlled by precessional cycle, which is one of the Millankovich cycles. Significant millennial-scale periodicity is also evident, and this finding may show that local climate change in Nagano City experienced the rapid climate change such as Dansgaard-Oeschger cycles in the Late Pleistocene time.

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Keywords: Takano Formation, Major elements, Lamina preservation degree, Precessional cycle, Dansgaard-Oeschger cycles, Nagano City

APE031-16

Room:104

Time:May 25 18:15-18:30

Reconstructing the history of human interactions using a lacustrine sediment with special reference to Taritsu Lake

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Lacustrine sediments is one of the useful material to reconstruct environmental history since it contains no bias by people. Using sediment records, the history of Kiso-hinoki cypress forest was reconstructed comparing historical records to sediment records.

Kiso-hinoki cypress is one of the most beautiful trees in Japan. Over 10,000 trees have been cut every 20 years for *Shikinen-sengu* (rebuilding shrine) at Ise shrine. Therefore, the imperial forest was set up in 1906 to prevent the depletion of the forest. The forest was severely deforested in the early 17th century when many castles were built, but it was regenerated by the conservation during Edo period. The survey of buried wood also show the evidence. To understand the utilization of the forest and regeneration processes, 10 cores were recovered from Taritsu Lake on Shirasu mountain pass by a Russian peat sampler. Pollen analysis and phytolith analysis have been carried out on No. 6 and No. 10 cores because sedimentation was stable in western part of the lake where these cores were recovered. ¹⁴C analysis indicated that the bottom of No. 10 core was about 1000 cal. yr. BC and that of No. 6 was about 800 cal. yr. AD.

Dominant pollen taxa were Cupressaceae and *Quercus* subgen. *Lepidobalanus* type in all period. The analysis of No. 10 core indicates that stable cypress forest has been established before Christ. Cypress became one of the most dominant element around AD400. After the enactment of *Shikinen-sengu* at Ise shrine every 20 years, pollen of Cupressaceae decreased and the forest was gradually replaced by *Quercus* subgen. *Lepidobalanus*. The analysis of No. 6 core shows that the percentages of Cupressaceae pollen decreased dramatically and the expansion of secondary forests is surmised by the increase of *Quercus* subgen. *Lepidobalanus* in the early 17th century. However, the decrease of the concentration of *Quercus* pollen can be observed indicating the depletion of the forest. After that, *Tomeyama* (the area prohibited to use all forest resources), prohibition to cut 4 kinds of Cupressaceae trees and prohibition to cut 5 kinds of Cupressaceae trees were enacted in 1662, 1708 and 1720, respectively. Since then, the forest seems to recover based on the pollen analysis, but the productivity became less than before the early 17th century. Entering the Meiji restoration, the imperial forest was set and conservation activity continued. Recovery of the forest can be observed by pollen analysis, but *Quercus* forest expanded. It may be ascribed to the production of charcoal for economical development during Japanese industrial revolution and building rail roads. After the world war II, *Pinus* forest developed due to the reconstruction of the devastated county.

It is considered that cutting undergrowth was carried out from the old time to promote the growth of cypress seedlings and therefore active regeneration occurred. Also, it is considered that the recent less activity of cutting undergrowth prevents the regeneration of cypress trees. To understand the management of the forest during Edo period, phytolith analysis was conducted at the depth of 73-75cm which is around AD1610, 39-40cm which is late 19th century when Meiji restoration occurred and 3.5cm which is close to the present. The result shows that there is no remarkable difference among the samples in the number of phytolith of *Sasa* type. Not cutting undergrowth seems not to be the factor which prevents the regeneration of cypress trees. *Sasa* has constantly grown around Shirasu mountain pass. Both results at the depth of 73-75 cm and 39-40cm showed the similar tendency. The phytolith of *Pleioblastus* type was observed at both depths. It indicates that *Pleioblastus* invaded to the open space where cypress trees were cut down. However, the phytolith of *Pleioblastus* type was not observed at the depth of 3-4 cm. The area has become the place which received little sunshine.

Keywords: *Kiso-hinoki* cypress, Taritsu Lake, pollen analysis, phytolith analysis, shikinen-sengu (rebuilding shrine), conservation

APE031-17

Room:104

Time:May 26 08:30-08:45

Climate changes during the past 47 ka deduced from TOC and TN contents of the sediment core BIW07-6 in Lake Biwa

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The organic carbon (TOC) and the nitrogen (TN) were measured at 1 cm interval for a sediment core (BIW07-6) taken from a site of 55 m depth off Okinoshima in Lake Biwa. As several ¹⁴C dates have been already reported by Kitagawa et al.(2010), BIW07-06 core can provide reliable age model for detailed age determination, associated with marker tephra ages. The ¹⁴C dates are calibrated based on IntCal09. The bottom of the 18.42 m-long core is estimated as old as 47 ka, and data interval is 28 years on average.

For example, TOC amount show a little high values, 0.6 to 1.0 %, in 47 to 30 ka, and low values, 0.3 to 0.9 %, in 30 to 14 ka. There is distinct low during 30 to 28 ka. TOC increases quickly from 0.9 to 1.5 % between 14 ka and 10 ka. After 10 ka, TOC amount is high as 1.5 % on average, with a long periodic fluctuation. This pattern of TOC fluctuation is very similar to those of BIW95-4 (Yamada et al., 2004), BIW07-5 (Kuriyama, 2011) and BIW08-B cores. The temporal change of TOC amount of BIW07-6 core can represent biological productivity in the whole Lake Biwa. This TOC profile is concordant with vegetation change clarified by pollen analysis for BIW95-4 core (Hayashi et al., 2010). One case study shows that total organic carbon (TOC) content of lake sediment is controlled mainly by winter temperature via biological productivity of lake water (Kumon et al., 2005).

Temporal TOC profiles of lake sediments in Lake Biwa can be proxy records for past temperature, and the temperature changes shown by TOC peaks also can be correlated to short warm periods named Interstadial 1 to 12 in Greenland ice core records. TOC data from BIW07-6 core could be a standard to reconstruct paleoenvironments and paleoclimate in Lake Biwa for the past 47 ka.

Keywords: BIW07-6core, Lake Biwa, TOC

Japan Geoscience Union Meeting 2011

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

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APE031-18

Room:104

Time:May 26 08:45-09:00

TOC, TN and stable isotope study on the BIW07-5 core off Nagahama in Lake Biwa, Japan

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A piston core (BIW07-5), 13.77 m long, was collected at a 50 m-deep site off Nagahama in Lake Biwa, Japan in 2007. The sediments are mostly homogenous clay silt associated with some marker tephra beds such as K-Ah, Sakate, DHg, DSs, AT and SI. Total organic carbon (TOC) and total nitrogen (TN) contents were measured at every 2-cm interval (70 years interval), and delta 13Corg were analyzed for every 10-cm interval (350 years). TOC and TN (and also C/N ratio) fluctuate concordantly with delta 18O of North Greenland Ice Sheet Core (NGRIP) in detail. The biological productivity in Lake Biwa seems to be well controlled by the temperature around Lake Biwa which has a strong connection with the temperature in the North Atlantic region via circum-Arctic atmosphere circulation.

The record of delta 13Corg from BIW07-5 core has a similarity the NGRIP ice core, although a slight discrepancy exists. We tried to consider which factor mainly control the delta 13Corg of lake sediment in Lake Biwa. The temporal change of radius of diatom shell (*Stephanodiscus pseudosuzukii*) from BIW08-B core off Okishima in 2008 seems to have similar trend with the change of delta 13Corg of BIW07-5 core. This result suggests that growth rate of phytoplankton in lake water may affect delta 13Corg of lake sediments. The growth rate may have a positive relationship with air temperature in general.

Keywords: BIW07-5 core, Biwa Lake, TOC, carbon isotope ratio

APE031-19

Room:104

Time:May 26 09:00-09:15

Holocene paleoenvironmental changes of the marine - terrestrial interface area in western Izumo Plain, western Japan

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Izumo Plain was formed by the aggradations with sediment supply of from the Hii and Kando Rivers. The history of development of Izumo Plain has been reported by a lot of previous studies. The purpose of this study is to clarify the environmental history with high-resolution analyses in marine - terrestrial interface area, western Izumo Plain. For this purpose, INB core was obtained by mechanical boring system. The total length of INB core is 19.17m, and divided by seven units.

Gravel Unit (19.17-18.89m in depth) is mainly characterized by gravel supported texture containing rounded to sub-rounded gravel (about 1cm), and it seems alluvium base deposit. Greenish Gray Sandy Silt Unit (18.89-15.94m in depth) mainly composes of silt to very fine sand. Total organic carbon (TOC), total nitrogen (TN) and total sulfur (TS) contents show the low value (<0.1%). This suggests fresh-water environment where a lot of inorganic materials were supplied from river. Organic Silt Unit (15.94-10.53m in depth) is mainly olive black massive silt, occasionally with obscure lamination. *Haplophragmoides canariensis* (foraminifera) and *Ruppia maritima* (plant seed) occurred in the upper part of this unit. The volcanic ash layers are observed around 11m in depth, and may be identified with the Shigaku Ash Fall Deposit, based on AMS ¹⁴C age. In this unit, TOC content shows the increasing trend from the lower (about 0%) to upper part (about 5%), TOC/TN ratio shows relatively high value (about 15) and TOC/TS ratio shows relatively low value (about 2). These features suggest that this unit was formed under brackish-water environment with the reduced condition that the terrestrial higher plant materials were supplied. Tuffaceous Sand Unit (10.53-3.67m in depth) composes of fine to very coarse sand with many pumice. Deposits of this unit may be derived from the Taiheizan Pyroclastic Deposit (about 3700 yrs BP). Sandy silt Unit (3.67-1.50m) composes of fine sand to silt with lamination (partly cross-lamina). TOC content shows relatively high value (0.5-4.3%) whereas TS content shows low value (<0.1%). TOC/TN ratio is relatively high value (17-30). These evidences suggest that this unit deposited under fresh-water environment that the terrestrial higher plant materials were supplied. Cultivation Soil Unit (1.50-1.07m in depth) composes of organic-rich mud with sand, and contains plant seeds that indicate paddy field (e.g., *Oryza sativa* and *Schoenoplectus sp.*).

Previous paleoenvironmental studies of boring cores in the Izumo Plain have reported the horizon around K-Ah tephra indicate marine environment containing echinoid fossil. However, the same horizon of INB core was likely to indicate brackish-water environment that the terrestrial higher plant materials were supplied. It is suggested that this core site was located close to the estuary of the Kando River. For this reason, we will be able to discuss both the influences of marine and river systems during mid-Holocene.

Keywords: Izumo Plain, stratigraphy, Holocene, Total organic carbon content, paleoenvironment

APE031-20

Room:104

Time:May 26 09:15-09:30

Absolute paleointensities for the Aso welded tuffs extruded with tephra: Calibration points for relative paleointensity

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Paleointensities of the geomagnetic field determined by welded tuffs can be used as calibration points in relative paleointensity curves if widespread tephra which were extruded with the welded tuffs have been recognized in sediments and dated on the basis of oxygen isotope records (Takai et al., 2002). In order to provide calibration points of virtually no error in age for relative paleointensity, we have conducted absolute paleointensity measurements of four welded tuffs of 90-270 ka (Aso-1, 2, 3, and 4) which were extruded with widespread tephra.

Using these welded tuffs containing volcanic glasses, we can carry out paleointensity experiments on both glassy and rocky parts of them. Thermal and alternating-field demagnetizations indicate that blocking-temperature and coercivity of the glassy parts show narrower distribution than those of the rocky parts. These data suggest that magnetic minerals of the glassy parts are relatively uniform in size and/or titanium content compared to those of the rocky parts.

The low-temperature demagnetization (LTD)-double heating test (DHT) Shaw paleointensity method was applied to 31 glassy and 72 rocky samples, respectively. From 15 successful results of glassy samples, mean paleointensities were obtained as 19.5±3.0, 20.2±2.0, 27.7±4.0, and 32.7±3.7 micro-T for the Aso-1, 2, 3, and 4 welded tuffs, respectively. From 33 successful results of rocky samples, mean paleointensities were obtained as 20.9±4.4, 23.9±2.5, 30.3±7.9, and 33.5±5.2 micro-T for the Aso-1, 2, 3, and 4 welded tuffs, respectively. The agreements between paleointensity values from different materials indicate that the paleointensities determined in this study are reliable. Therefore, these paleointensities can be used as calibration points for relative paleointensity curves.

Keywords: welded tuff, tephra, paleointensity, LTD-DHT Shaw method

APE031-21

Room:104

Time:May 26 09:30-09:45

Paleoclimate changes in continental Asia inferred from Baikal and Hovsgol lacustrine sediment records

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Lake Baikal and Lake Hovsgol, both of which occupy Baikal rift basin, are located in the central part of continental Asia. Lacustrine sediments of these two lakes record long-term environmental changes in the continental interior. In the present study, we analyzed abundances of chemical components of these two lake sediment cores. In the Lake Baikal sediment, the uranium concentration shows a similar fluctuation pattern with the biogenic silica concentration (as a paleotemperature proxy) on a glacial and interglacial scale (i.e., 100-kyr periodicity), whereas these two chemical components an inverse correlation on a centennial to millennial scale during the interglacial and interstadial periods. This means that sedimentation process of biogenic silica and uranium in Lake Baikal is different from each other, suggesting that the uranium concentration of sediment is paleoclimate proxy different from palotemperature proxy (i.e., paleomoisture proxy). Also, comparison of the Baikal uranium concentration with the Hovsgol detrital component indicates a positive correlation during the late Holocene each other. Based on the above assumption, climate of continental Asia become wet condition during the interglacial and interstadial periods and dry condition during the glacial periods. In addition, the climate during interglacial and interstadial periods is characterized by alternation of cold-wet and warm-dry conditions.

Keywords: Paleoclimate changes, Continental Asia, Lacustrine sediments, Lake Baikal, Lake Hovsgol

APE031-22

Room:104

Time:May 26 09:45-10:00

Changes of precipitation and evaporation in Central Asia estimated from paleo-lake level changes in Balkhash Lake

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Environmental change in Arid areas of Central Asia are caused by changes in water balance, for example, rainfall, evapotranspiration, infiltration, storage, runoff and fluctuation of ice volume in mountain areas. These environmental changes have huge effects on the environment in Central to East Asia. Accordingly, it is important that we discuss changes in water balance in order to reveal environmental changes in the arid areas.

Balkhash Lake is the huge shallow closed lake in Kazakhstan, Central Asia. The bottom sediment is composed of clay and abundant microfossils. The sediment core sample of Balkhash Lake must preserve records of paleo environmental changes not only in regional Ili river basin but also in the wide Central Asia.

We obtained the 6m length core in the west part of the lake in 2007 and such analyses were carried out, as fossil diatom and ostracod, pollen, geochemistry and grain size. Age control of the core is based on Cs-137 for the uppermost part and radiocarbon ages of fossil ostracods from the core. Furthermore, the terrestrial reservoir effect in this area is estimated by modern dead ostracods in surface sediments of the lake.

Diatom analysis shows mainly two different types of assemblages. One is characterized by dominance of freshwater planktonic species, and another is dominated by saline planktonic, saline benthic and freshwater benthic species of diatom. The first one suggests higher lake level, and the second one suggests lower lake level, as same interpretation as Stoermer and Smol (1999). Moreover, these assemblages changes are consistent with the observatory records of lake level during the last 120 years. According to the occurrence of these assemblages, the core shows eleven high lake level stages being dominant in freshwater planktonic species and eleven low level stages (about 0-300AD, 330-360AD, 750-790AD, 880AD, 1060AD, 1140-1180AD, 1260AD, 1490AD, 1560-1600AD, 1840AD and 1970-1990AD) dominant in saline planktonic species, saline benthic species and freshwater benthic species in the last 2000 years. Moreover, high proportion of fossil ostracoda and high C/N ratio correspond to each low level phase during 2000-1060AD. Also, the correlation was recognized between fossil brackish ostracod number (n/g) and relative abundance of saline planktonic and benthic diatoms. However, these tendencies of ostracod and C/N ratio changed after 1060AD. Namely, high proportion of ostracod and high C/N ratio are recognized in high lake level stages. It is possible that Ili river mouth changed from central part to west part of the lake in 1060AD. In addition, those low level stages, including around 0-300AD are consistent with the lake level changes in Aral sea chiefly inferred from changes of fossil dinoflagellates assemblages and Ca ratio (Sorrel et al., 2006).

On the low lake level events around 0-300AD, some topographic evidences are observed along the shore of Balkhash lake, and gypsum crystal-rich horizon is found in Aral Sea core (Boroffka et al., 2009). In the lake level change during the last 100 years, diatom assemblages after 1970 are different from the assemblage before 1970. Particularly, *Tryblionella complexa* is observed in the last 30 years. It suggests the influence of human activities including land use (Kubota, 2005) and effects of construction of the Kapchagai dam.

Keywords: Balkhash lake, lake level change, diatom analysis, ostracod analysis, pollen analysis, C/N

APE031-23

Room:104

Time:May 26 10:00-10:15

Provenance of quartz in coarse silt fraction of sediments from Yangtze River drainage and its paleoclimatic application

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Whereas precipitation brought by East Asian summer monsoon [EASM] is essential to maintain lives of large population living in that area, precipitation by EASM and tropical cyclone [TC] may also cause floods and ruin those lives. Consequently, it is crucial to predict temporal and spatial variations of precipitation brought by EASM and TC. However, prediction of spatio-temporal variations of EASM and TC precipitation with ongoing global warming is difficult and known as examples of poor agreements among predictions by different climatic models. It is likely that the range of variability caused by global warming may exceed the range in the instrumental records and that some unknown non-linear response may exist. So, it is desirable to tune climatic models with paleoclimatic data characterized by wider range of variability. In this respect, paleoclimatic reconstruction of the EASM precipitation during the Holocene will provide valuable constraints for tuning climatic models.

Yangtze River drainage occupies the major part of South China ranging from 25 to 35 degree N. The position of EASM front, which is characterized by high precipitation, is considered as migrated from 35 to 20 degree N during the Holocene. On the other hand, tropical cyclones that are landed on South China frequently cause flood of Yangtze River, and their courses and frequencies varied with time and could be related to EASM intensity. Thus it is useful to reconstruct spatio-temporal variations of EASM precipitation and TC course and frequency during the Holocene. However, such attempt has never been carried out before with high resolution. Here we use electron spin resonance [ESR] signal intensity and crystallinity index of quartz in fine fraction of detrital materials in the Yangtze delta sediments to estimate source area of fine-grained detrital materials. First, we analyzed rivers sediments collected from various branches of Yangtze River to construct a database for provenance study. The result suggests that it is possible to differentiate detrital materials derived from the upper, middle, and lower reaches as well as southern and northern branches of Yangtze River. We then adopt this result to the core samples obtained from Yangtze delta. The result will be discussed in the session.

Keywords: Yangtze River, river sediments, provenance, East Asian Summer Monsoon, Tropical Cyclone, ESR

APE031-24

Room:104

Time:May 26 10:15-10:30

The enigma of monospecific planktonic diatoms in the Paleo-Kathmandu Lake during the middle Brunhes Chron

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The occurrences of monospecific planktonic diatom assemblages in the Paleo-Kathmandu Lake at Nepal Himalaya during the middle Brunhes Chron are enigmas because they indicate that the famous paradox of the plankton (Hutchinson, 1961) was not paradox at that time. In this study, we examined the assemblage structure and species diversity of planktonic diatoms over the past 600 kyr, to reveal the cause of the occurrences of the monospecific assemblages of planktonic diatoms. Before 300 ka, planktonic diatoms are characterized by few changes in assemblage structure and extremely low diversity, reflecting the formation of monospecific assemblages of *Cyclotella kathmanduensis* and *Puncticulata versiformis*. In contrast, after 300 ka, planktonic diatoms are characterized by frequent changes in the assemblage structure and relatively high average of diversity. The assemblage structure and species diversity of planktonic diatoms in the Paleo-Kathmandu Lake were controlled by lake-level fluctuations (ecological disturbances), which were ultimately induced by Indian monsoon climatic changes. Additionally, variations in the assemblage structure and diversity of the planktonic diatoms are explained in a manner to the so-called intermediate disturbance hypothesis (Connell 1978). Before 300 ka, low-frequency lake fluctuations probably encouraged evolutionary-level competitive exclusion, and resulted in the occurrences of monospecific planktonic diatom assemblages.

Keywords: planktonic diatoms, the paradox of the plankton, the Paleo-Kathmandu Lake

Japan Geoscience Union Meeting 2011

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

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APE031-25

Room:104

Time:May 26 10:45-11:00

The environmental changes during the Holocene at inland saline lakes in Turkey, Syria, and Egypt

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In 1991 a geo-archaeological research project in Turkey, Syria and Egypt was started. The project is part of the excavation of Kaman-Kalehoyuk by the Japanese Institute of Anatolian Archaeology, the excavation of Tel Seker al-Aheimar by the University of Tokyo, and the joint research project with Menoufia University in Egypt. The project is a multidisciplinary research program, focused on the environmental history of the Neolithic and later periods in this region. More in detail, our research is aimed at a high resolution environmental reconstruction in order to make clear the climatic development during the Holocene, and its impact on human societies. We undertook field surveys at inland lakes and marshes surrounding archaeological sites in the Konya basin in Central Turkey (Lake Tuz, Lake Seyfe, Kayseri and Kaman Kalehoyuk), Lake Khatouniyeh in northeastern Syria, and Lake Qarun and Wadi Natrun in northern Egypt.

The warming and very dry climate could be observed in the data from all our drillings in the early Holocene in Egypt and Turkey. The humid climate during the Holocene recovered at first in the northern part of Syria at 8500 years BP. in the drillings from Lake Khatouniyeh. At 6500 years BP, about 2000 years later than Syria, the Holocene humidity started at the northern part of the central Turkey, at Lake Seyfe and Kultepe, Kayseri. The three times of fluctuation between arid ? humid environment have occurred after then. The cyclic fluctuation of humidity was also observed in Lake Qarun in Egypt. The lake level of the lake was fell down after the 2200 years BP in the Ptolemaios period , and fluctuated its level with hundreds years intervals.

The above-noted recovery of humidity and its regional variability in the Holocene presumably was one of the major causes for the archaeological events, especially with regard to water availability.

Keywords: Archeological events, Climatic change, Lake sediment, Holocene, Egypt, Turkey

APE031-26

Room:104

Time:May 26 11:00-11:15

Changes of sedimentological environment during the Holocene in Lake Qarun, Faiyum Basin, Egypt

kazuyoshi yamada^{1*}, Yoshinori Yasuda², Yoshitsugu Shinozuka³, Hitoshi Yonenobu¹

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Faiyum Basin, which is a big depression, connected to the Nile Valley via a lateral distributary and 70km from Memphis, the ancient Egyptian capital. Lake Qarun is located at the north end of the basin. The Lake is 40 km in length, 5.7 km in width and 43 m below sea level with a mean and maximum depth of 4.2 and 8.4 m, respectively. There is no outflow river from the lake at present, thus retaining the saline water environment due to high evaporation in summer. The salinity of the lake water is almost the same as that of sea water (Flower et al., 2006).

We attempted to recover continuous sedimentary records over the Holocene in order to reconstruct the geographical history of the lake, which were influenced both by climate changes and anthropogenic impacts possibly due to an ancient Egyptian civilization.

Sediment coring was undertaken in 2008 and 2010. A total of three sediment sequences were recovered within three km in distance. Faiyum08-1 core was 20.35 m in length, taken from the southern part of the lake shore. QRN10-1 and 02 cores were 28.25 and 18.00 m, respectively, taken on the lake. The site of QRN10-1 core is closer to a small river mouth than that of QRN10-2 core.

The lithology and stratigraphy were quite well correlated with each other. The chronology obtained from multiple radiocarbon dates and varve counting suggests that the sediment sequence is almost continuous since the 10,000 calBP years ago. These allow us to establish the history of the sedimentological environment during the Holocene, in relation to the lake level fluctuation.

The sedimentological sequence was classified and interpreted as below:

1- Pleistocene beach and fluvial sand deposition (before ca. 10,000 calBP)

Well shakeout of fine to medium rounded sand particles were deposited with shell fragments.

2- Yellowish thin laminated (varved) lacustrine mud (ca. 10,000 to 9,000 BP)

Thin alternations of white diatomite and yellowish mineralogenic layers were deposited. Dominant diatom assemblages in the white layer were *Aulacoseira granulate* and *Stephanodiscus*, suggesting that the layers were formed in winter. Yellowish mineralogenic layers deposited during dry seasons in summer.

3- Dark greyed thin laminated (varved) lacustrine mud (ca. 9,000 to 5,000 BP)

Thin alternations of white diatomite and grey mineralogenic layers were deposited. Dominant diatom assemblage in the white layer was *Aulacoseira granulate*, suggesting that the layer was formed in winter. Grey layers deposited during dry seasons in summer. The difference of the sediment colors in 2- and 3- may reflect the changes of source materials from the Nile. The former is originated from the White Nile (mainly quartzite), the latter is from the Blue Nile (mainly volcanic materials as Basalt).

4- Grey homogenous mud (5,000 to 2,000 BP)

Generally greyed homogenous mud deposited with remarkable diatomite thick layers. In some parts, it was identified intercalated gypsum crystal and iron-oxide thin layers.

It is suggested to start shrinking the lake with a large fluctuation due to high evaporation with dry climate condition.

5- Brownish homogeneous mud / deltaic sand deposition (after ca. 2,000 BP)

Generally, brownish homogeneous mud was deposited with pottery fragments. Also, fine to coarse sand with cross bedding was observed particularly in QRN10-1 core, indicating the development of channels into the lake. This sedimentary environment is similar to modern condition.

Thus, the sedimentological environment in Lake Qarun over the Holocene was reflected by lake level changes, and mostly coincides with the geomorphological data in the Basin (Hassan, 1986). Our new findings were as follows: a drastic and major Nile flood occurred at the beginning of the Holocene (9,935 +/- 230 calBP). The flood could be the first one in this region, and may have caused an intrusion of fresh water immediately fulfilled the basin (at least 15 years) as well as the sapropel in the eastern Mediterranean (Calvert and Fontugue, 2001).

APE031-27

Room:104

Time:May 26 11:15-11:30

The Late Holocene paleoenvironment in the hypersaline Lake Suribati, East Antarctica

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The ice sheet of the Antarctica is affected by the climate change, and repeats progression and regression. Many of hypersaline lakes in the Antarctica were formed by the uplift of the continent with the regression of ice sheet. For this reason, the hypersaline lakes may record paleoenvironment after the regression of glaciers. It is considered that the Lake Suribati was a part of the sea, and isolated from seawater for glacioisostatic rebound. After that, it seems that isolated seawater has been concentrated by evaporation, and the hypersaline lake water formed. However, the environment change in the lake water after the isolation is not revealed enough. This study purpose is to clarify a paleoenvironmental history and the process of formation in the hypersaline Lake Suribati used by geochemical, sedimentological and paleontological methods.

Lake Suribati is located in the Skarvsnes, East Antarctica. This lake is the maximum depth of 34m and an area of about 0.41km². The water level of this lake is 33m below mean sea level, and lake separated from marine by the sill of 15m altitude. Salinity shows hypersaline for 40 - 200 psu, and the halocline observed at depth 7 - 12m. The environment of bottom water under halocline shows euxinic condition.

This study used to sediment core Sr4C-01 (length 63cm) in Lake Suribati by the 46th Japanese Antarctic Research Expedition, and is performed chemical analysis, grain size analysis and paleontological observation.

AMS radiocarbon age has been obtained from three horizon. The ages of core bottom (depth 63cm) was estimated to be 3500 cal yrs BP based on the sedimentation rate. Sr4C-01 core mainly composes of mud with lamination. The mean grain size of Sr4C-01 core was fluctuated between 6 and 7 phi. Mode was recognized in 3 - 4 phi and 6-8 phi, showing bimodal distribution. This suggests existence of at least two depositional systems. Total organic carbon (TOC) contents were about 1% below a depth of 10cm, and about 2 - 3% above this horizon. The fluctuation of TOC contents has the cyclic seven peaks of about 350 years interval. TOC/TN ratios were about 8. This is suggest that the organic matters were produced by phytoplankton in the lake. TOC/TS ratios were about 2 below a depth of 30cm, and increased upward above a depth of 30cm. For that reason, the bottom environment in situ shows the reduced condition below a depth of 30cm, and change to relatively oxidized condition above this horizon. The species of open sea of silicoflagellates and diatom were occurred in core bottom, but did not occur from core top. CaO and MgO contents in sediment core have anomalously values between 9 and 30cm in depth. The mineral grain in the sediment sample of high CaO content was analyzed by XRD method, and was identified with aragonite. It is considered that aragonite precipitated on the surface sediment during the concentration process of isolated seawater with evaporation.

From these evidence, it is seem that Lake Suribati isolated from sea before the at least 2,200 cal yrs BP. The lake water in Lake Suribati has been concentrated by evaporation during 2,200 - 1,000 cal yrs BP, and the hypersaline lake water formed.

Keywords: Antarctica, hypersaline lake, sediment core, TOC, evaporite, diatom

APE031-28

Room:104

Time:May 26 11:30-11:45

The glacial landforms and erosional features on the Antarctic continental shelf

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Previous geological and geomorphological works about glacial history on land around the Lutzow-Holm Bay and Mt. Riiser-Larsen regions have indicated that the maximum expansion age of the East Antarctic Ice Sheet is not corresponding to the Last Glacial Maximum (LGM: ~23 to 19 ka) in the CLIMAP model. The various types of glacial landforms and erosional features on the continental shelf in the East Antarctic region have been confirmed from the submarine topographic surveys using a multibeam echo-sounder with new vessel Shirase during the JARE-51 and 52 seasons. These submarine topographic data such as glacial grooves, drumlins, mega-scale glacial lineations and iceberg furrows tell us some suggestions as follows: (1) Iceberg furrows indicate that the continental shelf is covered by thick sediments, (2) Very flat surface of continental shelf with mega-scale glacial lineations has been made by the sedimentation processes of ice sheet, (3) Such topographic features and their distributions imply that the East Antarctic Ice sheet had at least once advanced to the limit of main continental shel, though their age is unknown.

Keywords: Antarctica, Continental shelf, Glacial landform, Quaternary, East Antarctic Ice sheet, Glacial history

APE031-29

Room:104

Time:May 26 11:45-12:00

Modeling biogeochemical cycles and climate during oceanic anoxic events

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Atmosphere-ocean-system has been oxygen-rich conditions for much of the Phanerozoic Eon. However, widespread black shale depositional intervals termed oceanic anoxic events (OAEs) occurred sporadically under warm climate conditions (e.g., the mid-Cretaceous). Several lines of evidence suggest that mid-Cretaceous OAEs are linked to extensive volcanism. However there is no consensus as to the identity of underlying mechanism of OAEs, although some causal mechanisms have been suggested; such as ocean stagnation, enhanced biological productivity in the surface oceans, and an oxygen solubility decrease due to global warming. To simulate the oceanic redox state and global climate variation during OAEs quantitatively, we developed an atmosphere-ocean biogeochemical cycle model that involves geochemical cycles of carbon; several chemical reactions in an oxic-anoxic-sulfidic water column (such as denitrification, nitrification, sulfate reduction); and redox-dependent phosphorus (P) regeneration in surface sediments for paleoceanographic applications. This model includes the total dissolved inorganic carbon (DIC), $\delta^{13}\text{C}$ of DIC, total alkalinity (Alk), oxygen (O_2), phosphate (PO_4), nitrate (NO_3), ammonium (NH_4), sulfate (SO_4), and hydrogen sulfide (H_2S) as dissolved chemical components of seawater, and can calculate the variation of atmospheric partial pressure of carbon dioxide. To explore the conditions for occurrence of OAE, we examined the effect of the massive CO_2 release event on biogeochemical cycles. The systematic sensitivity experiments of oceanic redox states indicate that (1) enhanced P input rate is an important mechanism for widespread anoxia via expansion of oxygen minimum zone and coastal deoxygenation, resulting in massive P efflux from surface sediments, (2) oceanic anoxia is easily achieved in case of low ocean circulation rate, but those are not enough to achieve global anoxia/euxinia by itself, and (3) high sea-level conditions act as a buffer against oceanic eutrophication (and OAEs) supporting the results of Bjerrum et al (2006). We will also present the discussions of required CO_2 input rate for global OAEs.

Keywords: oceanic anoxic events, biogeochemical cycles, phosphorus cycle, anoxia/euxinia

Japan Geoscience Union Meeting 2011

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

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APE031-30

Room:104

Time:May 26 12:00-12:15

Toarcian OAE (Early Jurassic) in the northwestern Panthalassa: Did anoxia and negative CIE occur synchronously?

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The Early Toarcian oceanic anoxic event (T-OAE) is marked by the deposition of organic-rich black shales that indicates an abrupt negative carbon isotopic excursion (CIE) of carbonates, organic matter, and fossil wood. This characteristic carbon-isotopic perturbation has been well documented in selected sections in the European domain, which belonged to either Boreal or Tethys regions, but it has not yet been well recognized in the shelf setting of the northwestern Panthalassa. In this study, we present, for the first time, reliable data for carbon isotopic ratios of organic matter, total organic carbon (TOC), and lamina preservation index (LPI) from the shallow marine sequence of the latest Pliensbachian to the middle Toarcian age in the northwestern Panthalassa (Sakuraguchi-dani Valley section in Toyora area, west Japan). We recognized the T-OAE strata which indicate high TOC values and well preserved lamination. The LPI data suggest that the anoxia in the shelf setting of the northwestern Panthalassa was not a single event but was interrupted by episodic bottom-water oxygenation events. The characteristic CIE is recognized in the early Toarcian, and the obtained carbon-isotope profile of organic carbon matches well with those of the contemporaneous strata in the western Tethys and Boreal regions. In the study section, however, high TOC and well-preserved laminated strata occurred synchronously with positive shift of the carbon isotope values after the negative CIE. This evidence seems to suggest that the global warming, which occurred after the negative CIE, was the main cause of the T-OAE.

Keywords: oceanic anoxic event, Toarcian (Early Jurassic), carbon isotope, total organic carbon, lamination, Toyora area

APE031-31

Room:104

Time:May 26 12:15-12:30

Variations of palaeovegetation recorded by terrestrial plant biomarkers in the mid-Cretaceous sequence in Hokkaido

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The Early Cretaceous is an interval of exceptional interest for understanding the early evolution and expansion of angiosperm. The reconstruction and ecological interpretation of the Cretaceous flora, however, are far from complete because of some disadvantages of classical palaeobotanical and palynological studies (e.g. Rare occurrence of morphologically well-preserved fossils). Therefore, palaeovegetation and palaeoenvironment trend through the Early- to Mid-Cretaceous remain largely ambiguous. Several studies suggested that higher plant terpenoid in the marine sediments records palaeovegetational change involved with climatic variations [eg. 1]. In this study, biomarker analysis were carried out for the Aptian to Cenomanian sediments of the Oyubari area, central Hokkaido, Japan, in order to reconstruct uncharted vegetational history of early angiosperms in the Eastern margin of Eurasia.

The sediments studied comprised 24 mudstone and 2 tuffaceous sand stone sampled along the outcrop of exposed along the Tengu-sawa Valley in the Oyubari area, Hokkaido. The angiosperm fossils hitherto reported from Albian in the Yezo Group. Powdered samples were ultrasonically extracted by methanol (MeOH), MeOH/dichloromethane (DCM) and DCM. The lipid extract was separated by silica gel column to four fractions. Aliphatic lipid and Aromatic lipid fraction were analyzed by GC/MS.

The maturity indices of C_{29} steranes ($20S / (20S + 20R)$) show almost constant value through the studied section, reaching the late diagenesis to catagenesis stage. The $C_{27}/(C_{27}+C_{29})$ sterane values (approx. 0.35), high Pristane/Phytane ratio (ca. 4.0) indicate that predominance of terrestrial organic matter, which is concordant to previous reports by macerals observation and elemental analysis. Aromatic triterpenoids (oleanane type, ursane type, and lupane type) identified in this study are diagenetic derivatives originated from biosynthetic angiospermous triterpenoids (e.g. amyrin). Gymnosperm-specific diterpenoids (retene, simonellite, dehydroabietane, norabietatriene, and dehydroabietine) are also identified. The Early Cretaceous sediments are characterized by very low concentrations of aromatic triterpenoids, yet continuously detected from the lowermost sample studied (ca. >115.5 Ma) that predates earliest report of angiosperm fossil in Japan. The aromatic angiosperm gymnosperm index (ar-AGI) was calculated by ratio of total aromatic angiosperm triterpenoids to the sum of total aromatic angiosperm triterpenoids and total gymnosperm diterpenoids, as molecular indicator of angiosperm / gymnosperm vegetation [2]. Higher plant parameter (HPP) were also calculated in formula [retene/(retene+cadalene)], which is proposed to reflect conifer vegetation, especially sensitive to Pinaceae contribution [1]. The Ar-AGI values generally increase during the Albian (0.01-0.38), which suggests that angiosperm vegetation expanded in the hinterland, while HPP values remain high (ca. 0.8) indicate that gymnosperms were dominant through Early Cretaceous. In addition, the biomarker vegetation indices suggests that the change of angiosperm/gymnosperm relative importance in vegetation was not uniform trend, but recording significant short-term variation. Because palaeobotanical and climatic information are only available in much lower temporal resolution, change in the palaeo aridity/humidity are inferred from the variation in $d^{13}C_{\text{carbonate-wood}}$ using previously reported carbon isotopic profiles[3]. From the result, significant variety recorded in ar-AGI and HPP are suggested to reflect change in environmental condition such as aridity/humidity.

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Keywords: terrestrial plant biomarker, Cretaceous, angiosperms, palaeovegetation, palaeoclimate

APE031-32

Room:104

Time:May 26 12:30-12:45

Origin of rhythmical bedding in mid-Cretaceous lacustrine deposits, southeast Mongolia

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The mid-Cretaceous period is characterized by an extremely warm greenhouse climate, elevated atmospheric CO₂ levels, and repeated occurrences of Ocean Anoxic Events (OAEs); however, detailed processes and causal mechanisms of these marked events, particularly the response of terrestrial climate system, have been poorly understood. Possible causal mechanisms of OAEs in the mid-Cretaceous greenhouse climatic conditions include following mechanism; (1) increased terrestrial humidity and terrigenous input into the oceans, (2) enhanced ocean surface productivity, and (3) the excess of organic burial in the oceans. Increased terrestrial humidity and chemical weathering may have increased terrigenous input into the oceans (so called Weathering Hypothesis; e.g., Weissert et al., 1998; Hasegawa, T., 2003). To evaluate interaction between the land and the ocean during the mid-Cretaceous OAE interval, we investigated terrestrial paleoenvironmental changes using the mid-Cretaceous lacustrine deposits at intra-continental sites in central Asia (Gobi basin, southeastern Mongolia).

The mid-Cretaceous lacustrine deposits (Shinekhudag Formation) are widely distributed in southeastern Mongolia. The Shinekhudag Formation, well exposed in the Shine Khudag locality in the Shaazangiin Gobi area, is composed of dark grey paper shale (oil shale), light grey silty claystone, and whitish to yellowish calcareous claystone. Strata are continuously exposed up to 400 m in thickness. The shale and calcareous clay successions are rhythmically alternated (decimeter-, meter-, tens of meter-scale) in Shine Khudag locality, which can be controlled by orbital cycles. Paper shale deposits include micrometer-scale laminations, which are most likely varve origin. The estimated sedimentation rate is ca. 3-5 cm/k.y. by the varve-counting methods on thin sections. The age of the Shinekhudag Formation is assigned as Aptian or Barremian-Aptian based on the floral and molluscan evidence (Krassilov, 1982; Jerzykiewicz and Russell, 1991), and K-Ar dating of basaltic rocks in the uppermost part of the underlying Tsagantsav Formation (ca. 126 Ma: Graham et al., 2001).

In order to clarify the depositional environments and their controlling factors of the rhythmically alternated lithological change in the Shinekhudag lacustrine deposits, elemental analysis (C, N, S) and Rock-Eval pyrolysis were performed on the shale and calcareous clay samples. C/N values are significantly low (< 10) in the calcareous clay samples, while relatively higher (> 13) in the shale samples. Rock-Eval analysis shows significantly high hydrogen index (> 650 mg/g) in the calcareous clay samples, while slightly lower value (< 610 mg/g) in the shale samples. The most samples showed relatively high T-max values (430?440 °C). These results indicate that the organic matter of the Shinekhudag lacustrine deposits were mainly of algal origin (dominant in calcareous clay layer) but with relative higher contribution of other materials including terrestrial plants and/or cyanobacteria (relatively high in shale layer). These lines of evidence suggest that the rhythmically alternated shale and calcareous clay succession was formed by fluctuations in the lake-levels and associated changes in surface primary producers, which could be controlled by orbital-scale (probably also millennial-scale) precipitation changes during the mid-Cretaceous time.

Keywords: lacustrine, Cretaceous, organic matter, orbital cycle, Ocean Anoxic Events