Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

APE33-01 Room:103 Time:May 23 15:30-15:51

High resolution records in the Japanese coastal and slope regions for the last 3000 years

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Very recently, PAGES programme 2K network, to collect the best time series and spatial reconstructions of important state variables of the climate system, is ongoing. Behind the scenes is the awareness of an importance of the reconstructed maps and timeseries during the last 2 kyrs to be analyzed in combination with the best ensemble runs of existing Earth system models. In many parts of the globe high-resolution (spatially and temporally) paleorecords for comparison with model simulations are very sparse. This is particularly true for adequate paleoceanographic records because of the uncertainty of age and the limitation of resolution. Severe lack of paleoceanographic records for the last 2K could no longer be ignored to understand regional climate dynamics and the predictions. Here we present the work of high-resolution paleoceanographic reconstructions for the last 3K and discuss possibility of reconstruction of PDO-like climate patterns using TEX86 and alkenon thermometry and fossil scales of Japanese sardine in sediments of Beppu Bay, southwest Japan.

Keywords: ASIA 2K, Coastal and shelf/slope paleoceanography, TEX86, alkenon thermometry, Japanese sardine scale, PDO

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APE33-02 Room:103 Time:May 23 16:15-16:30

Temporal distribution in diatom assemblages from coastal area in Western Japan: The usability of diatom assemblages as a

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Diatom assemblage in sediment core is a useful proxy for dynamics of aquatic environment. However, more information about taxonomy, habitat, and taphonomy are required for coastal diatoms. Therefore,we investigated the relationship between temporal change of diatom assemblage and anthropogenic impacts (e.g., polution, environmental protection) recorded in sediment cores from Western Japan, and discuss the usavility of diatoms as a proxy of human-induced environmental changes. In Osaka Bay, diatom assemblages in three drilling core samples are classified into two indicator species-groups, i.e., assemblage 1 showing positive correlation, and assemblage 2 showing negative correlation between their valve abundance and human induced eutrophication, respectively. In our presentation, we will disscuss if these indicator species-groups are useful as proxies for human-induced eutrophication in broader area of Japan including Harima-Nada, Suo-Nada, and Lake Nakaumi, as well as Osaka Bay.

Keywords: diatom assemblage, coastal area, proxy, anthropogenic impact, eutrophication, Western Japan

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APE33-03 Room:103 Time:May 23 16:30-16:45

The feature of aquatic environment and surface sediment in the Lake Ogawara, Aomori Prefecture, north Japan.

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To analyze paleoenvironment and paleoclimate, we must understand the feature of sediments as recorder and recent environment. In particular, the coastal lagoon is necessary to investigate before performing the paleoenvironmental study because of shows each characteristic lake environment. In this study, we performed a field study in the Lake Ogawara from August 31to September 9, 2011, to clarify a characteristic of aquatic environments and surface sediments.

The Lake Ogawara, is located in east part of Aomori Prefecture, have a halocline around 20m for water depth throughout the year. The thermocline is formed around 10m for water depth in the summer season. Therefore, dissolved oxygen is not supplied in the intermediate water, and anoxic water mass thickens. In this study, we investigated in this timing. The investigation is made up of 110 detailed sampling localities in grid and 100 water quality measurement sites in a traverse line through the lake system.

In Lake Ogawara, the water temperature shows 24-25 degrees Celsius in surface water, and shows low with 9 degrees Celsius in bottom water. The thermocline was observed at 8-18m for water depth. The salinity in surface water is less than 2 psu, and is less than 1 psu around the delta of Hichinohe River. Salinity show high value with 12psu in bottom water, and halocline was observed at 8-18m for water depth. The water column of Lake Ogawara divided into 3 water masses, as an epilimnion (0-8m), a metalimnion (8-18m), and a hypolimnion (deeper than 18m).

The environments in metalimnion and hypolimnion show the anoxic to euxinic condition. The upper part of the metalimnion shows pycnocline dependent on water temperature and salinity, and the lower part shows pycnocline dependent on mainly salinity. The chlorophyll-a concentration is high in metalimnion and hypolimnion.

Surface sediments are observed well-sorted sand shallower than 6m, and black mud deeper than it depth. As a result of grain size analysis, the frequency distribution of muddy sediment have a mode at 3.5, 5.5, and 7.5 phi. It is considered that fraction of 3.5 phi was supplied from the seaside by density current flow because of the mode of 3.5 phi decreases southward. However, coarse fraction might be supplied by a tsunami because it was recognized over the lake basin.

As a result of CNS element anaysis of surface sediments, the total organic carbon (TOC) contens increase toward deep, and show very high value (around 8%) in metalimnion and hypolimnion. This value is high in comparison with the other coastal lagoon as a Nakaumi Lagoon, Lake Shinji, Lake Abashiri, and Lake Mokoto. This high values were caused by high productivity, low velosity of decomposition by the anoxic to euxinic condition, and low sedimentation rate. TOC contents show high value near the delta of river. This is suggested that terrestrial higher plant add to organic matter of in lake production because of high C/N ratio.

Total sulfur (TS) content shows 1-2% of values deeper than metalimnion. In spite of euxinic condition, TOC/TS ratio is high in comparison with the normal marine. This suggests the exhaustion of metal ions such as iron or undersupply of sulfate ion.

Keywords: Coastal Lagoon, Lake Ogawara, TOC content, C/N ratio, TS content, anoxic condition

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APE33-04 Room:103 Time:May 24 09:00-09:15

Glacial climate and thermohaline circulation: an ocean biogeochemical modeling toward direct comparison with proxy data

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The deep ocean circulation in the present climate is characterized by the existence of the Atlantic meridional overturning circulation (AMOC) accompanied with deep water formations in the Labrador and Greenland Seas. This circulation consists of sinking part in the northern North Atlantic Ocean and upwelling part in the Southern and Pacific Oceans. Although the flow in the deep ocean is very slow, it carries huge amount of water in the deep ocean and the heat transport associated with this circulation has a great influence on the climate. In addition, because the ocean stores large amount of carbon (60 times larger than that of the atmosphere), the deep ocean circulation significantly affects the carbon cycle in the climate system. From both physical and biogeochemical aspects, the deep ocean circulation is one of key factors controlling the climate system.

During glacial climate, abrupt climate changes known as Dansgaard-Oeshger events are considered to be caused by changes in the AMOC. The thermohaline circulation is also believed to have an important role in the changes in atmospheric CO2 concentration from glacial to interglacial periods. Simulation of the Last Glacial maximum has been a target of the Paleoclimate Model Intercomparision Project (PMIP), and various coupled climate models have challenged the LGM simulation by following the protocol proposed by PMIP. Therein, substantial differences in the glacial AMOC among models have been observed, with half of models simulating a weakening of the AMOC while the other half simulate a strengthening. Because paleo proxy data such as d13C and 231Pa/230Th ratio suggest that the AMOC became shallower and reduced by up to 30 % during the LGM compared with the present climate, it is widely believed that the AMOC during the LGM is weaker than that at the present climate. However, a couple of studies using another paleo proxy data, Nd isotope ratio, imply that the AMOC during the LGM may be almost the same or even slightly stronger than the present one. This means that there is also discrepancy among paleo proxy data themselves or their interpretation.

In order to validate climate model simulations directly with paleo proxy data, explicit simulation of these proxy data with ocean biogeochemical model is getting important recently. Such simulations are also very helpful for interpretation of proxy data because they can quantitatively evaluate which processes are important for controlling the distribution of paleo proxy. In this talk, recent attempts for simulation of paleo proxy with biogeochemical model are introduced.

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APE33-05 Room:103 Time:May 24 09:15-09:30

Reconstruction of the sedimentary environment using sea sediments in the northwest Australia

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The reconstruction of sea-level changes is the key not only to understand the Earth climate changes but also to predict the mantle viscosity. The Bonaparte Gulf in the northwestern Australia is located in a broad and well-developed shallow continental shelf. During times of sea-level lowstand, much of the shelf was exposed (Yokoyama et al., 2000; 2001). The Bonaparte Gulf has the Bonaparte Depression, which is the deepest part of the Gulf and has Ven Diemen Rise, Londonderry Rise and Sahul Rise. Sahul Rise is the shallowest Rise in them. The region is tectonically stable and far from the former ice-covered regions. The glacio-isostatic adjustment of the coast is therefore relatively small. So this region is suitable for the reconstruction of the sea level and evaluating the solid earth property using differential heights of the rsl at given times in the past using the restoration of the relative sea levels.

Yokoyama et al. (2000; 2001), which got sea-level information from the Bonaparte Gulf using radiocarbon dating and sediment core facies, reached the conclusion as

1) the LGM (Last Glacial Maximum) sea levels were locally at 125+-4 m;

2) the LGM terminated abruptly at 19 000 cal yr BP with a rapid rise in sea levels of about 15 m over the next 500 years

3) the onset of the minimum sea levels occurred before 22 000 cal yr BP.

In the cruise of KH11-1, a total of 1 piston core, 22 gravity cores and 6 multiple cores are collected. The number of cores is enough to reconstruct the tilting in this region. This study analyzed three cores, PC1, GC6 and GC9. We used the proxies of TOC, CN ratio and radiocarbon dating to reconstruct sea-level change and the tilting.

In this study, paleoenvironmental information is obtained using the habitat of shell samples found in the cores. We used AMS radiocarbon dating to determine the age of samples in MALT. Calendar ages were obtained using 14C curve marine09 (Reminer et al., 2009). We constructed age-model in PC1, GC6 and GC9.

The dried sediments of PC1, GC6 and GC9 were used for total organic carbon (TOC) and total nitrogen (TN) analyses. We obtained these data using EA-IRMS in Kochi Core Center.

Using dry bulk density (DBD: g/cm3) of the sediments and the liner sedimentation rate (LSR: cm/yr), we calculated the mass accumulation rate (MAR: g/cm2 yr) .

We constructed age-model for each core using the well-preserved shell samples. In PC1, GC6 and GC9, we plotted calendar age vs. TOC and CN ratio. PC1 does not have the hiatus and the water depth of PC1 (St. 1) site is 140 m below the present, so the lowest sea level was above -140m.

From 28 cal kyr BP, in PC1, TOC, CN ratio is gradually increased. This indicated that the catchment was spread in the Bonaparte Gulf by the cause of Sahul Rise exposed. MAR is reduced at the same timing, because the rise of the velocity of the current in the Gulf due to the post glacial transgression that the channel to the open (Timor Sea) became narrower as Sahul Rise being exposed. The depth of the water at Sahul Rise is about 60 m, so sea level at 28 cal kyr BP was about 60 m below.

In this study, we proved that at about 28 cal kyr BP Sahul Rise was exposed and the sea level is about -60 m.

We will reconstruct sea-level change and tilting at the broader area in the Bonaparte Gulf and predict the mantle viscosity from the estimation of the crustal tilting in future work.

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APE33-06 Room:103 Time:May 24 09:30-09:45

Origin of magnetic mineral concentration variation in the Southern Ocean

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In the Southern Ocean, magnetic mineral concentration increases in glacial periods. The variation pattern closely resembles eolian dust flux records from Antarctic ice cores, but the cause of the linkage remains unclear, as the dust flux is too small for the source of terrigenous materials in the Southern Ocean. We have conducted an environmental magnetic study of late Pleistocene sediments from the south Indian Ocean to investigate the origin of the magnetic concentration changes. Biogenic magnetites can be detected using the characteristics of almost no magnetostatic interactions and narrow coercivity distribution, reflecting occurrence of single-domain magnetites in a chain. We interpret that a non-interacting component on first-order reversal curve diagrams and low-coercivity components with small dispersion from isothermal remanent magnetization (IRM) component analyses represent biogenic magnetites, and that the interacting and middle-coercivity components represent terrigenous maghemites. The ratio of anhysteretic remanent magnetization susceptibility to saturation IRM reflects relative abundance of the biogenic and terrigenous components. It was revealed that biogenic magnetites are a dominant constituent of the magnetic minerals. In glacials, the abundance of both biogenic and terrigenous components increased with increased proportions of the latter. Increased ocean productivity in glacials is suggested from increased proportions of biogenic magnetites with elongated morphologies, indicative of less-oxic conditions, and increased sedimentation rates. These observations suggest that the increased magnetic concentration in glacials in the Southern Ocean may be explained by iron fertilization; the production of biogenic magnetites was enhanced associated with increased ocean productivity, which was fueled by increased eolian dust flux.

Keywords: rock magnetism, environmental magnetism, magnetic susceptibility, biogenic magnetite, southern ocean, paleoceanography

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APE33-07 Room:103 Time:May 24 09:45-10:00

230Th-normalized fluxes of biogenic components from the central-southernmost Chilean margin over the past 22,000 years.

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During the last glacial maximum, the atmospheric partial pressure of CO2 ($_pCO_{2atm}$) was quite low, 180-190 ppm and rapidly increased to 280 ppm during the last deglacation (Monnin et al., 2001). The combination of the biogeochemical (e.g. export flux, nutrient utilization) and physical processes (e.g. upwelling, stratification) has been considered to control $_pCO_{2atm}$. Considering the response of $_pCO_{2atm}$ on global climate changes, the polar ocean such as Southern Ocean is one of the most important area linking between atmosphere and ocean, because the deepest water mass can directly connects to the atmosphere and the largest carbon reservoir in the world oceans. During glacial periods, strengthened productivity and an efficient biological pump in the North Pacific, equatorial Pacific, and Southern Oceans may have contributed to low $_pCO_{2atm}$. However, there is still some controversy as to whether marine productivity was high everywhere during glacial periods. Resolving this controversy requires more data from many regions regarding temporal changes in past export fluxes of biogenic materials, especially in the eastern South Pacific Ocean including the Chilean marginal region, where active biological production is observed at present.

The aim of this study was to identify changes in the ^{230}Th-normalized export flux of biogenic components commonly used as proxies for paleoproductivity-namely total organic carbon (TOC), total nitrogen (TN) and biogenic opal (Si_{opal})-from two sediment cores collected at 36 ^{o} S off central-south Chilean covering the past 22 kilo years (kyr) (PC-1) and at 52 ^{o} S near the mouth of Strait of Magellan, Pacific side over the past 13 kyr (PC-3). In 13-8 Calendar kyr before present (cal kyr BP), the ^{230}Th-normalized TOC flux at the PC-1 site were relatively high pointing to increased productivity, and a marked decrease characterized the time around 13 cal kyr BP and 8-5 cal kyr BP. At the PC-3 site, the ^{230}Th-normalized TOC flux was low during the last deglaciation until 6 cal kyr BP. Our ^{230}Th-normalized fluxes suggested that biological pump would not have fully worked throughout 22-14 kyr BP and the early Holocene in the central-south Chilean and 13-6 kyr BP at southern most Patagonia. The entire trend of ^{230}Th-normalized biological components looks a latitudinal symmetrical change at PC-1 and PC-3 during the deglaciation-6 cal kyr BP. This trend in biological pump changes at both sites corresponded to changes on wind direction associated with latitudinal shift of Southern Westerly Winds (SWW) core, which might be affected by insolation, supporting the notion of orbital influence. The indirect connection between biological productivity and insolation might be explained by as a following hypothesis: during 22-15 cal kyr BP (or 13-10 cal kyr BP) at PC-1 site, when austral summer insolation became strong (or weak), it would make zonal wind inhibit (or strengthen) and would enhance the northerly (or southerly) wind associated with equatorward (or poleward) shift of SWW in the central-south Chile, and then the upwelling would have been suppressed (or active) resulting low (or high) productivity there. After 5 cal kyr BP, the ^{230}Th-normalized TOC fluxes at both sites were relatively high and an apparent zonal symmetry disappeared suggesting that the breakdown of zonal symmetry might reflect the onset of permanent El Nino-Southern Oscillation variability.

Monnin, E. et al. (2001) Science, 291, doi: 10.1126/science.291.5501.112.

Keywords: off Chile, Thorium 230, biogenic components, biological pump, Southern Westerly Wind

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APE33-08 Room:103 Time:May 24 10:00-10:15

Paloenvironment changes in the surface sediments of the Indian sector of the Southern Ocean

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Paloenvironment changes in the surface sediments of the Indian sector of the Southern Ocean (65 S)

Keywords: Antarctic Ocean, Indian sector, surface sediment, stable isotope, organic carbon, 14C

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APE33-09 Room:103 Time:May 24 10:15-10:30

Plio-Pleistocene reconstruction of East Antarctic Ice Sheet fluctuations

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Several major climatic transitions have occurred throughout the Plio-Pleistocene. The Pliocene climate optimum was a warm period, and is thought as very similar condition to the end of 21 century according to IPCC AR4. This warmth was ended by the late Pliocene transition that lead the climate to a colder and more glaciations in the Northern Hemisphere. The mid-Pleistocene transition marks the time when the periodicity of glacial-interglacial cycles varied from 41,000 years cycles to large-amplitude 100,000 years cycles. Since the above described climatic events are recorded in the benthic foraminifera oxygen isotopes, as is the measure of global ice volume primarily, strong link between cryosphere and global climate has been suggested. However little is known for the relationships in particular for the Antarctic ice sheet. The aim of this study is to reconstruct East Antarctic ice sheet (EAIS) fluctuation during the Plio-Pleistocne using exposure ages in various parts of East Antarctica, and to discuss the relationship between ice sheet fluctuations and global climate changes.

The concentration of *in situ* produced cosmogenic radionuclides (e.g. ^{10}Be, ^{14}C, ^{26}Al, ^{36}Cl) in quartz reflects the cumulative exposure time of the rock and provides the timing of final retreat of ice in the area. In the meantime, combinations of the nuclides can deduce further information in terms of nature of exposure histories, namely simple or complex exposure history for the sites. Isotopic ratios of two cosmogenic nuclides (e.g. ^{26}Al/^{10}Be ratio) can be used for these purposes and since this ratio indicates the erosional ability of ice sheet, we can reconstruct basal conditions of ice sheet in the past. For the case of warm-based ice sheets, the ice sheet basal temperature is above the pressure melting point and hence the bedrock surface is subjected to continuous erosion and resulted cosmogenic nuclides measurement exhibits a simple exposure history. In contrast, cold-based ice sheet cannot erode bedrock sufficiently enough to reset the exposure age ”clock” therefore inheritance of nuclides can be seen because of previous exposure ”memory”. The inheritance of nuclides as described above results in deviation of nuclide content from that predicted by both half-life and present day production rates. Compilations of the cosmogenic exposure ages from five ice-free areas of East Antarctica was conducted and re-calculated using new site specific production rates taken into account of realistic atmospheric pressure model in Antarctica since it deviates from standard atmospheric thickness significantly. I also added newly obtained ^{10}Be and ^{26}Al data for samples collected from Sor-Rondane Mountains, Droning Maud Land. The results indicate that the EAIS was thicker more than 600 m compare to the present, at least once prior to the 3 Ma. The EAIS had then become at least 400 m thinner from 3 to 1 Ma. Growth and decay of EAIS has repeatedly occurred with glacial-interglacial cycles during the Pleistocene epoch.

We successfully draw the picture of past fluctuations of EAIS throughout the Plio-Pleistocene. The EAIS was initially larger and more dynamic until 3 Ma and then it has become smaller as global climate cooled. Our direct evidence in terms of timing of ice sheet fluctuations together with previously published paleoclimate records suggest that inception of colder climate since 3 Ma inhibits active moisture transport to Antarctica that reduce the size of ice sheet. The relatively stable EAIS has become sensitive to changes in sea level namely EAIS has been dictated by variations in Northern Hemisphere Ice Sheets that is induced by Northern hemisphere high latitude insolation. Therefore global ice volume started to have 100,000 years cyclicities with larger amplitude between glacial and interglacial time since then due to relatively significant contributions from Antarctic ice sheet cased by sea-level changes.

Keywords: East Antarctica, ice sheet fluctuations, cosmogenic radionuclide dating, Pliocene climate optimum, Late Pliocene transition, Mid-Pleistocene transition

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APE33-10 Room:103 Time:May 24 10:45-11:00

Summer monsoon intensity as a recording mechanism of the astronomical rhythm in bedded chert

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The astronomical cyclicity recorded as sedimentary rhythms provide a clue to understanding the dynamics of Earth surface system. Bedded chert consists of rhythmical alternations of chert and shale beds whose rhythms are paced by astronomical cycles (Ikeda et al., 2010). However, the recording mechanisms of the sedimentary rhythms of bedded chert were still debated. To reveal their recording mechanisms, I attempted to extract paleoceanographic and paleoclimatologic information recorded in sedimentary rhythms of bedded chert on timescales of astronomical cycles based on the biogenic silica and terrigenous burial rates estimated for the bedded chert. To accomplish this objective, I conducted the major elements chemical analysis of individual chert and shale beds on the continuous sequence with bed-by-bed resolution. The biogenic silica and terrigenous contents were estimated, assuming the terrigenous material in the bedded chert as constant at the composition of the shale sample with the lowest SiO2 content among the samples analyzed, which is consistent with composition of the modern terrigenous material accumulated in the pelagic ocean. I calculated weights of biogenic silica and terrigenous material accumulated as a chert-shale couplet per unit area, which are well correlated with the chert bed thickness (r = 0.96) and shale bed thickness (r = 0.90), respectively. Based on these clear correlations, I regarded the chert bed thickness and shale bed thickness as approximate measures of biogenic silica and terrigenous burial rates, respectively, during one precession cycle, and reconstructed the variation in the biogenic silica and terrigenous burial rates during the Early Triassic to Early Jurassic for the bedded chert sequence in the Inuyama area. Together with paleogeographic distribution of bedded chert compiled from previous studies, the biogenic silica burial rate in the low latitude Panthalassa ocean in the form of bedded chert was a half to several times higher than the biogenic silica burial rate in the modern ocean (DeMaster, 2002). This result suggests that bedded chert was the major sink of dissolved silica in the ocean at least during the Early Triassic to Early Jurassic. Therefore, the variations in the biogenic silica burial rate in the bedded chert should be proportional to the variations in the dissolved silica input to the ocean, mainly through river input, in time-scales longer than the residence time of the dissolved silica in the ocean, 15 kyr (e.g. Treguer et al., 1995; Gaillardet et al., 1999). According to the geochemical modeling studies, the orbitally controlled summer monsoon intensity could have been a possible major controlling factor of the global silicate weathering intensity (Kutzubach, 1981). Therefore, variations in the orbitally-controlled summer monsoon intensity in Pangea should have had close association with variations in the biogenic silica burial rate in the form of bedded chert during the Early Triassic to Early Jurassic.

Keywords: chert, weathering, silica, Milankovitch, monsoon, eccentricity

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APE33-11 Room:103 Time:May 24 11:00-11:15

Trace element behaviors during the end Permian mass extinction at the deep sea floor.

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We describes the variations of trace-elemental compositions that took place in the paleo-super-ocean Panthalassa during the end-Permian mass extinction, based on the sedimentary rock samples from one of the most continuous Permian-Triassic boundary section of pelagic deep-sea, exposed in the northeastern Japan area. Our measurement shows high concentrations of redox-sensitive elements such as Molybdenum (Mo), Vanadium (V), and Chromium (Cr) are present in the Upper Permian to end-Permian strata in the study section.

Vanadium concentration shows two peaks in the section. First one is in the Changhsingian chert beds without any co-increase of another trace elements. Second one is recognized in the uppermost part of siliceous claystone and the basal black claystone bed which accords the end-Permian mass extinction. Mo shows high concentrations at the upper part of Changsingian siliceous claystone bed and overlying the base of the black claystone. These Mo concentrations are followed by high Chromium concentrations. The final peaks of Mo coincide with that of V. Above the horizon characterized by high concentrations of V, Mo, and Cr, any significant increase dose not detected from the Changhsingian to Induan black claystone. Rapid uptakes of V, Mo, Cr into the sediment require reduction in their valences. The single peak of V from Upper Permian chert beds suggest moderately reduced bottom water condition, because first step of reduction of V require relatively weak reduced condition. While second-step reduction of V and Mo reduction require strong reduced condition. Additionally, reduction of Cr requires moderately reduced condition which is corresponded between first-step and second step reduction of V. Hence, the co-occurrence of high concentrations in Mo and V at the basal black claystone which accords the end-Permian mass extinction suggest maximum reduced condition at least the sediment-water interface at that time. Therefore, this line of variations in trace element concentrations indicates a progressive reduced deep-water condition in the central Panthalassa, and the onset of the end-Permian black claystone is characterized by euxinic maxima at the Panthalassic sea floor. Such expanded euxinic deep waters might represent an important causal factor in the end-Permian mass extinction in central Panthalassa.

Keywords: mass extinction, trace element, euxinia, pelagic deep-sea, Panthalassa

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APE33-12 Room:103 Time:May 24 11:15-11:30

Compositional changes of organic matter and carbon isotope stratigraphy through the mid-Cretaceous lacustrine deposits

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Cretaceous oceanic anoxic events (OAEs) are well known perturbation events of carbon circulation over the earth surface. Oceanic environments during the events are well documented from marine sequences based on paleontological and geochemical characterization. On the other hand, lack of tools for precise inter-regional correlation between marine and non-marine sequences prevents us from discussion of dynamic environmental changes involving causal relationship between terrestrial and oceanic phenomena.

This study focuses on mid-Cretaceous Aptian-Albian terrestrial sequences from southeastern Mongolia that have been located deep inside of the Eurasian continent since Cretaceous and presumably record the climatic responses on the continent to OAE1a and OAE1b. The Shinekhudag Fm., and formations below (Tsagantsav Fm.) and above (Khuhuteg Fm.) exposed in the Shine Khudag location, Shaazangiin Gobi area are studied to cover majority of the sequence to construct a composite section. The Shinekhudag Fm., the main part of the studied section, is composed of alternating beds of dark greyish paper shale, greyish calcareous shale, light greyish dolomitic marl, and whitish to yellowish dolomite. Total range examined here is 490 m in thickness including sampling gap derived from bad outcrop conditions.

Carbon isotope value (d13C) of total organic matter trough the composite section exhibits general trend of gradual drop between 200 m and 330m (lower half of the Shinekhudag Fm.). However, some adjacent samples shows considerable difference as large as 6 permil suggesting that the d13C fluctuation does not only reflect secular variation of 13C/12C of ocean-atmospheric carbon reservoir but also changes in mixing rate of organic matter derived from different primary producers. It is also suggested from scattered stratigraphic distribution of C/N ratio ranging 3 to 38. Rock-Eval pyrolysis on selected 15 samples including that with C/N ratio over 20 shows high hydrogen index values over 400 mgHC/gTOC for all samples. This fact indicates contribution of terrestrial plant fragments in the sediments is not significant in the Shinekhudag Fm.

Cross-plot diagram of d13C and C/N ratio exhibits clear negative correlation for all sample sets from the Tsagantsav and Shinekhudag formations. It indicates that both parameters are controlled by a same factor in these formations. It is mixing rate of two types of organic matter produced by contrasting organisms. One of them is represented by normal lacustrine algae that has C/N ratio around 6 and the other is by unknown producer that has hydrogen index as high as algae, C/N ratio around 30 and d13C values 3 permil more negative relative to algae. The regression lines of the sample sets show parallel distribution and 4 permil of gradual negative sliding within the Shinekhudag Fm. Carbon isotopic shifts of two end components with same magnitude reflecting change in 13C/12C ratio of atmospheric CO2 is the most plausible explanation for this gradual sliding of the regression line. Applying this d13C fluctuation to chronostratigraphy, it is correlated to the long-term negative shift through the early Aptian after OAE1a.

Although carbon isotope stratigraphy is a powerful tool for international chronostratigraphic correlation (Ogg et al., 2008), its application to terrestrial sequences has been limited because of the difficulty of source evaluation of organic matter. Evaluation using C/N-d13C regression line in a cross-plot diagram can give clue to application of d13C chronostratigraphy to lacustrine sedimentary rocks.

Keywords: Cretaceous, lacustrine, carbon isotope, organic carbon, oceanic anoxic event

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APE33-13 Room:103 Time:May 24 11:30-11:45

Orbital-scale lake-level and productivity changes in the mid-Cretaceous lacustrine deposits in southeast Mongolia

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The mid-Cretaceous period is characterized by an extremely warm greenhouse climate with 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 the terrestrial climate system, are only poorly understood. To evaluate interactions between the land and the ocean during an OAE interval, we examined the terrestrial climatic record from Aptian lacustrine deposits (Shinekhudag Formation) in southeast Mongolia.

The Shinekhudag Formation is widely distributed in southeastern Mongolia, and is well exposed in the Shine Khudag locality. The formation is composed of alternating beds of dark greyish paper shale, greyish calcareous shale, light greyish dolomitic marl, and whitish to yellowish dolomite. Strata are continuously exposed up to 250 m in thickness. The shale and dolomite successions are rhythmically alternated (decimeter-, meter-, tens of meter-scale), probably controlled by orbital-cycles. Shales and dolomitic marls show micrometer-scale lamination (alternation of organic- and detritus-rich layers), most likely reflecting seasonal cyclicity. The sedimentation rate is estimated as ca. 4-8 cm/kyr based on varve-counting of thin-sections.

In order to clarify the depositional environments and the controlling factors for the rhythmically alternating lithofacies change in the Shinekhudag lacustrine deposits, we conducted X-ray diffraction analysis to reconstruct changes in the sediment mineralogy, and we also performed elemental analysis (C, N, S), Rock-Eval pyrolysis, and a quantitative study of palynofacies to evaluate the organic matter composition in the shale and dolomite couplets. Both, the sediment mineralogy and organic matter composition of lacustrine deposits are controlled largely by hydrological factors that are highly dependent upon climatic fluctuations. The results revealed that the cyclic alternations (ca. 1-1.5 m cycles) of the dolomite abundant layer and detritus minerals and calcite rich layer, corresponding to the rhythmically alternating dolomite and shale layers of field observation. C/N values were significantly low (4-10) in the dolomite layers, while higher values (15-30) occur in the shale samples. Rock-Eval pyrolysis revealed that all the samples are composed of Type I-II organic matter. Palynofacies analysis further indicated dominance of Botryococcus colonies in the dolomite layers, whereas the shale layers show abundant amorphous organic matters, algal cysts, and terrestrial palynomorphs.

These lines of evidences indicate that the rhythmically alternating lithofacies changes recorded in the Shinekhudag lacustrine deposits were mainly controlled by orbital-scale lake-level changes as well as by lake productivity changes. Namely, the dolomite layers were formed during low lake level by microbially mediated precipitation in highly alkaline lake waters. Botryococcus colonies were abundant under such oligotrophic and euryhaline conditions. On the other hand, the shale layers were deposited during high lake levels, which were characterized by higher algal productivity and increased inputs of detrital minerals. Spectral analysis of the lithofacies change in the Shinekhudag Formation shows the cycles involving approximately 1.28 m, 2.27 m, 5.88 m, and 22.4-25.6 m cycles, corresponding to periodicities of approximately 21 kyr, 38 kyr, 98 kyr, and 373-427 kyr, respectively, based on a varve-tuned average sedimentation rate of 6 cm/kyr. These values are in accordance with orbital precession, obliquity, and eccentricity cycles, respectively. Therefore, the Aptian lacustrine deposits in southeast Mongolia are interpreted to record the orbital-scale paleo-hydrologic changes during the OAE1a-1b interval.

Keywords: lake-level change, Cretaceous, orbital-cycle, paleo-hydrology, land-ocean linkage, Ocean Anoxic Events

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APE33-14 Room:103 Time:May 24 11:45-12:00

Climate modeling for the mid-Pliocene warm period and model-model intercomparison

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The mid-Pliocene warm period (mPWP; 3.3~3.0 Ma) is the most recent interval when global climate was substantially warmer than the present-day for a sustained time with the modern geographical distribution of continent and ocean. The effort for simulating the climate in this interval would advance validations of climate models predicting future climate change and to the estimation of ”Earth system sensitivity”.

As a part of the United State Geological Survey (USGS) Global Changes Research effort, the Pliocene Research Interpretation and Synoptic Mapping (PRISM) Project has documented the characteristics of climate in mPWP on a global scale by use of various types of proxy records. The PRISM datasets have been used to drive numerical simulations designed to explore the impact of climate forcing and feedback during the Pliocene and assess the reproducibility of climate simulations derived by general circulation models (GCMs) in this period. The Paleoclimate Modeling Intercomparison Project (PMIP), a worldwide framework for studying on the paleoclimate reconstructions and simulations, has focuses on mPWP as one of new target intervals in its latest phase (PMIP3). By applying the latest version of the PRISM dataset (PRISM3D, Dowsett et al. 2010) for prescribed boundary forcings, Pliocene modeling intercomparison project (PlioMIP) was proposed to access the reproducibility of global climate models for mPWP climate simulations (Haywood et al. 2010, 2011). PRISM3D dataset contains all surface boundary conditions, topography, vegetation, land ice, and also deep ocean temperature for initial condition in air-sea coupled climate simulations. Under the experimental protocols, several results derived by climate models had already been reported.

We conducted the PlioMIP Experiments 1 (with atmospheric general circulation model, AGCM) and 2 (with atmosphere-ocean coupled general circulation model, AOGCM) using with MRI-CGCM2.3 (Yukimoto et al. 2001, 2006), which was also used in the third phase of the Coupled Model Intercomparison Project (CMIP3) and the second phase of the PMIP [1, 3, 4]. We also represent Pliocene biome prediction over the land using with equilibrium biogeography model, BIOME4, under the climate state simulated by the AGCM and AOGCMs [2, 4]. The biome simulations could help to compare general characteristics of surface climate patterns among the simulations by a single index translated from some elemental climate parameters and facilitate quantitative model-model or data-model comparisons.

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Keywords: paleoclimate, mid-Pliocene, climate model, PRISM, PlioMIP, biome

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APE33-15 Room:103 Time:May 24 12:00-12:15

Reconstruction of the tectonic activity in the southwestern Tarim Basin and its relationship with desertification

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Tectonics and climate linkage is one of the most important problems in Earth Science. Uplift of Tibetan Plateau is one of the most remarkable tectonic activities in the Cenozoic. Although climatic simulation studies suggest the possibility that uplift of Tibetan Plateau triggered the desertification of Tarim basin (e.g. Kitoh, 2005), the linkage between the two has not yet been proved. The major reasons that hamper proving the linkage are the difficulty in constraining the timing of the tectonic activity relative to the timing of desertification, and uncertainty in defining the onset of desertification. In this study, we tried to overcome these problems by extracting the climatic and tectonic information from the same sedimentary record using newly developed method to specify the onset of desertification.

We conducted a field research at the Yecheng section in the southwestern Tarim Basin. Fulvial to alluvial deposits with occasional intercalations of eolian sediments deposited between 7.6Ma to 1.8 Ma are continuously explosed along the Yecheng section (Zheng et al.,2010; Tada et al., 2010). We identified eolian sediment and river sediment in the field, and measured Electron Spin Resonance (ESR) signal intensity and crystallinity index (CI) of quartz in two size fractions of the sediments.

ESR signal intensity of quartz reflects the age of mother rock (Toyoda and Naruse, 2002), whereas CI of quartz reflects physical condition of its formation such as temperature and rate of crystallization (Murata and Norman, 1976). We used these two parameters to identify the provenance of quartz. In her study of river sediments in the Tarim basin, Isozaki (2009MS) suggested that quartz in coarse fraction (>64um) of river sediments reflects bedrock geology of the catchment area based on ESR signal intensity and CI of quartz. So, if tectonic uplift or lateral movement by faults occur in the catchment area, the assemblage of rock exposed in the catchment area should change, and we can detect the onset of tectonic activity by examining ESR signal intensity and CI of quartz in the coarse fraction. On the other hand, fine fraction (<16um) in river sediments may reflect geology of the river catchment area and eolian dust. So we can evaluate contamination of eolian dust by comparing ESR signal intensity and CI of quartz between fine and coarse fractions.

In this study, we applied these methods to the fluvial and alluvial sequence at Yecheng section to examine the relationship between tectonic activity in northwestern Tibet and desertification of the Tarim basin. The result will be presented at the meeting.

Keywords: Tarim Basin, Desertification, Tectonics, Fault, Provenance study, Eolian dust

Japan Geoscience Union Meeting 2012
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APE33-16 Room:103 Time:May 24 13:45-14:00

Palaeogeographic reconstruction of the 1.55 Ma synchronous isolation of the Ryukyu Islands, Japan, and Taiwan and inflow

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Below is abstract shown in Osozawa et al., 2011, International Geology Review. The Ryukyu islands evolved from a continental margin arc to their present configuration as an island arc, accompanied by subsidence and isolation of islands, by back-arc spreading of the Okinawa trough that continued to the present. The time of island isolation is recorded by trough-parallel half grabens filled by marine siltstone, as well as such sediments filling orthogonal fault-controlled and other non-fault-controlled valleys surrounding each island. New Quaternary nannofossil biostratigraphic data shows deposition marine siltstone noted above at 1.55 Ma. At that time, the entire 1000-km-long island chain comprising the Ryukyu islands separated from Asian continent by rifting extending from the Okinawa trough to the Tsushima strait. The Tokara, Kerama, and Yonaguni gaps, branched or transverse rifts of the Okinawa trough, separate the island chain into subgroups of the Osumi, Amami, Okinawa, and Yaeyama islands, and Taiwan. The shallow Taiwan strait separated Taiwan from the Chinese mainland. The Kuroshio warm current that previously ran off shore of the continental margin arc, began to flow into the opening backarc basin through the Yonaguni gap and flow out the Tokara gap, flowing along the axis of the Okinawa trough. Under influence of the warm current and because of entrapment of the Yellow and Yangtze rivers detrital sediments by the Okinawa trough, coral reefs formed around each isolated island. These reefs make up a unit called the Ryukyu limestone. Subsidence continued through the deposition of this limestone, resulting in further isolation of each island. Some islands did not separate from the mainland but emerged later from the sea as a result of volcanic edifice construction or forearc uplift. Following initial isolation the Japanese islands and Taiwan may have been connected to the mainland by land bridges during some sea level lowstands related to glacial periods, whereas the other islands remained isolated. Based on ages of isolation of each island, a Quaternary paleo-geographic map and phylogenetic tree of the islands can be drawn showing the separation time of the each island from the mainland and each other. This information should be useful for phylogenetic molecular biologists studying evolution of the Ryukyu endemic species and vicariant speciation, and facilitate analysis of DNA substitution rate.

Keywords: Ryukyu island arc, Okinawa Trough, island-encircling 1.55 Ma marine sediments, .55 Ma island separation, Kuroshio current, coral sea

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(May 20-25 2012 at Makuhari, Chiba, Japan)

APE33-17 Room:103 Time:May 24 14:00-14:15

Polycystine radiolarian fauna and paleoceanographical changes in the Shimokita Peninsula through the last 750 ky.

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The Northwestern Japanese Pacific Ocean margin is a region presenting high water masses mixing caused by the influences of three distinct currents (the Kuroshio Current, the Tsugaru Current, and the Oyashio Current). Our Studied Site, the Shimokita region located in front of the Tsugaru Strait, is a region directly influenced by the Tsugaru Warm Current, and the Oyashio Subarctic Current. Many studies of this region concerning the last 50 ky have been conducted for understand this region oceanographic changes through the late Pleistocene. At this time there are no long term palecoceanographical studies of this region for period older than the last 150 ky. In this context the core hole C9001C drilled at the 1,180 m water depths of the sea-bottom in the D/V Chikyu 2006 Mission, is an excellent example of a stratigraphic succession off Japan. This core has a high sedimentation rate and provides a nearly continuous record from MIS 18 (750 ka) to present, covering the Brunhes normal polarity epoch. Polycystine radiolarians due to their water masses vertical distribution, and their ecological properties is the most efficient micropaleontological proxy for establish paleoceanographical study of this region. The purpose of this study is to establish the first long term polycystine radiolarian assemblages faunal evolution of this region, and discuss the polycystine radiolarian faunal evolution through the last 750 ky. In this context we will focus our study on the unusual climatic change event as the Matsuyama/Bruhnes magnetic susceptibility reversal period, the Mid Bruhnes event (400-300 ky after Jansen et al., 1986), the MIS 9, the MIS 8 and the MIS 6.5 (Martinson et al., 1987).

Keywords: Polycystine Radiolarian, Paleoceanography, Fauna evolution, Mid Bruhnes Event, MIS 9, MIS 8

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APE33-18 Room:103 Time:May 24 14:15-14:30

Dynamics of millennial-scale variation in East Asian Summer Monsoon intensity and its relation to the Westerly jet

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Recently, increasing evidence demonstrated the occurrence of multicentennial to millennial-scale climate changes during the Holocene (e.g., Bond et al., 2001; Mayewski et al., 2004). Although some of these climate changes were inferred to be global-scale, the spatial extent and physical mechanisms of these changes are still controversial. In the East Asia, millennial-scale variations of the East Asian summer monsoon (hereafter call EASM) intensity have been examined using the best-dated records of stalagmite-derived oxygen isotope from caves in central China (e.g., Wang et al., 2005; Hu et al., 2008). However, due to the spatial heterogeneity of the EASM precipitation changes (e.g., An et al., 2000; Dayem et al., 2010), stalagmite-derived oxygen isotope records seem to represent local or regional variations of the EASM precipitation, not to represent dynamic changes of the EASM. Therefore, we need additional records to examine the nature and spatial extent of the EASM variations during the Holocene.

To date, many additional records representing the EASM precipitation changes were reported from lacustrine, loess-paleosol, and peat bog sediments in China, and marine sediments of the surrounding oceans. Among them, we selected the records with high sensitivity and chronological precision, and examine the multicentennial- to millennial-scale spatial changes of the EASM precipitation during the Holocene. Furthermore, here we focused on the role of the westerly jet (hereafter call WJ) on the spatial precipitation pattern of EASM (e.g., Liang and Wang, 1998; Sampe and Xie, 2010). Sampe and Xie (2010) demonstrated that eastward advection of warm air from the eastern flank of the Tibetan Plateau along the WJ axis triggers the convection that forms the rainband and further that the WJ anchors the rainband by guiding transient weather disturbances, which promote convection by intensifying moisture advection with upward motion. Therefore, the WJ is necessary to develop a rainband at middle to high latitude of East Asia. In our previous study, we presented provenance changes of the aeolian dust in Japan Sea sediments reflect the earlier/later jump of the WJ to the north of the Tibetan Plateau (Nagashima et al., 2011). Then here we reconstructed provenance changes of the aeolian dust in Japan Sea sediments during the Holocene, and compared the results with spatial precipitation changes in China.

Examination of the paleo-precipitation records in China and provenance of dust in Japan Sea sediments reveals large events around 9.5, 8.3, 5.5, 2.2, and 0.4 kyr BP, with large contribution of aeolian dust from the Taklimakan Desert (we interpret as representing earlier jump of the WJ to the north of the Tibetan Plateau) together with the large precipitation in northern China (e.g., Hong et al., 2005) and small precipitation in central to southern China (e.g., Hu et al., 2008; Kubota et al., 2010). This may indicate that multicentennial to millennial-scale changes of the (seasonal) WJ path during the Holocene caused dynamic changes of the EASM precipitation, with earlier jump of the WJ to the north of the Tibetan Plateau increased precipitation in northern China and decreased precipitation in central to southern China.

The presented events were coincide within the dating error with the events revealed from the GISP2 sodium and potassium ion records, which are considered as reflecting the intensity of Icelendic Low and Siberian High, respectively (Mayewski et al., 1997; Meeker and Mayewski, 2002), and the events revealed from the stalagmite oxygen isotope record from Pink Panther Cave in southwestern United States, which is considered as reflecting (at least partly) precipitation of North American monsoon, suggesting the events spread at least hemispheric-scale and reorganization of the atmospheric circulation systems may happen from low to high latitudes. We will further discuss the possible cause of the coupled WJ-EASM variations during the Holocene.

Keywords: East Asian Summer Monsoon, Westerly Jet, Millennial-scale, Quartz, Electron Spin Resonance

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APE33-19 Room:103 Time:May 24 14:30-14:45

The separation from global and local components of climate signals by comparison between two lake sediments

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East Asian Monsoon (EAM) is dictating many parts of East Asia including Japan. In summer, EASM (East Asian Summer Monsoon) brings moist and warm climate in the region, whereas EAWM (East Asian Winter Monsoon) is characterized as cold and relatively dry air originated from Siberian High, which intensified in boreal winter. According to paeloclimate archives, there had been frequent rapid climate changes both in and outside of North Atlantic region during the last glacial period, which ended up at around 10 ka. The ultimate mechanisms are still unknown though it has been pointed out that ocean circulation had been played an important role (Yokoyama and Esat, 2011).

In order to reconstruct past environments, stable isotopes are a useful tool and can be used as fingerprints of events because of their unique values of each materials. One of which is stable 87Sr isotope and is usually produced by decay of 87Rb. From measured 87/86Sr isotopic value of samples and expected source, it is able to estimate the source areas of sample materials, and also their degree of contribution.

Lake Biwa and Lake Suigetsu are located only 20 km in distance at very similar latitude, so they are expected to have influences from regional climate in similar fashion. However, these two lakes have different catchment areas, so it is expected to be able to separate global and local signatures of environmental changes comparing two lakes.

In this study, samples from Lakes Biwa and Suigetsu are analyzed by ICP-MS. Concentrations of 61 elements are measured, and Sr isotopic ratio using TIMS for 30 samples from sediment of Lake Biwa are also analyzed. Sedimentary fluxes are fluctuated in the sediments, though the timing and magnitude of changes are not identical. From comparison of data sets of two lakes, the fluctuation of Aluminum flux indicated that sedimentation of lakes are correlated to each other, suggesting that the sedimentation of two lakes are mainly controlled by climate systems, whereas the period between 45˜37 ka are not correlated. The divergence found in the sedimentary characteristics might have controlled by local environmental changes in these two lakes. Further, Aluminum flux fluctuation showed clear cyclic peak during Last glacial to present which timings are correlated to Heinrich Event (which is known as ice rafting event of North Atlantic).

Strontium isotopic ratios in Lake Biwa sediment showed similar peak with Aluminum, which are correlated with HE. This indicates the change of source areas of sediment had occurred at the time of HE.

This study demonstrated that the merits of measuring two nearby lakes, which have different geological settings. From comparison of two lake sediments, regional and local influences to two lakes were successfully separated.

Keywords: lake sediments, lake Suigetsu, lake Biwa

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APE33-20 Room:103 Time:May 24 14:45-15:00

Effects of age uncertainty on the Site 609 IRD record

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The last-glacial hematite-stained grain record (HSG) obtained from classic DSDP Site 609 was originally reported to exhibit 1476+/- 584 year cyclicity and interpreted to indicate the presence of a ”1500-year cycle”. Here, this record is reinterpreted in the context of an updated chronology based on newly calibrated radiocarbon dates (Marine09) from 15 to 35 ka and correlation to the North GRIP ice core layer-counted chronology (GICC05) to 60 ka. This new age model results in periodicity at primarily ˜1000- and ˜2000-years, bands that are both consistent with the original reported results and periodicity of related Holocene proxy records.

A ˜1500-year oscillation is also detected. However, it is non-stationary and mainly limited to the interval from 60 to 70 ka, the age of which is derived solely from an ice flow model (ss09sea), subject to the highest uncertainty of the entire record, and exhibits the greatest offset from the original chronology. The effects of age uncertainty on cycle length were modeled, and results indicate that the 1500-year oscillation is less robust than the 1000- and 2000-year oscillations. Though the presence of a 1500-year cycle cannot be entirely ruled out, similar analysis of synthetic series constructed from sine waves of corresponding frequencies indicate that it is a relatively minor component.

Keywords: IRD, periodicity, age model

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APE33-21 Room:103 Time:May 24 15:00-15:15

Temperature and salinity estimates in the Japan Sea during the past 18 kyr

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The Japan Sea has shallow 4 straits (<130 m) that connect to the Pacific Ocean to exchange seawater, and thus sea-level lowstand (ca.-120 m) during the LGM might had limited vigorous seawater exchange between the Japan Sea and the Pacific through the straits. Only through the narrow and shallow Tsushima strait, the glacial Huang He River supplied fresh water to the semi-closed Japan Sea, forming low-saline surface conditions at the time (e.g., Oba and Murayama, 1995). This low-saline surface condition during the LGM was relieved by intrusion of Oyashio Current into the Japan Sea through the Tsugaru strait from 18 ka (Oba and Murayama, 1995). Although Ishiwatari et al. (2001) have tried to reconstruct sea-surface temperatures (SSTs) during the past 36 ka based on alkenone unsaturation ratio, the low-saline conditions during the early deglacial periods make SST estimates from alkenone uncertain (Harada et al., 2008; Fujine et al., 2006). Here, we present planktic foraminifera Mg/Ca-derived SST and Ba/Ca ratios, together with benthic and planktic foraminifera $d^{18}O$ from a sediment core in the Japan Sea.

The studied sediment core (YK10-7-PC09) was taken from 738 m water depth off Niigata. The thick lamina layer was observed in a section from 420 cm to 750 cm core depth, which corresponds to the sediments during Heinrich 1 and glacial periods and we have used the sediment samples above 450 cm core depth. The age model for the core was based on 7 AMS ^{14}C data of planktic foraminifera. We have used Marin09 and dR of 0+/-100yr to convert the conventional ^{14}C ages to the calibrated ages. $d^{13}C$ and d^{18} of benthic (*Uvigerina.* spp) and planktic foraminifera (*N.incompta*, *N.pachyderma(s)*, *G.bulloides*) were measured by MAT 253 (CMCR, Kochi University), whereas trace metal/Ca ratio of planktic foraminifera were measured by Thermo Finigan Element II (University of Toyama). Precision (1sigma) of Mg/Ca, Mn/Ca, and Ba/Ca ratios obtained by the SF-ICP-MS in our laboratory was 0.97%, 0.49%, and 1.63%, respectively.

The $d^{18}O$ records from planktic foraminifera were almost same as the records from L-3 core (Oba and Murayama, 1995), and one of striking features is a significant increase of $d^{18}O$ values from 0.6 permil to 3.4 permil during the early deglaciation (18-15 ka). The Mg/Ca-derived SSTs (from *G.bulloides*) showed a slight increase from 5 to 8^{o}C during 18-7 ka; SSTs did not change significantly during 18-15 ka and warmed ~3^{o}C during the B/A period. Importantly, the SST evolution in the Japan Sea exhibited a close similarity with the SST variation reconstructed off Tokachi under the influence of Oyashio Current (Sagawa and Ikehara, 2008), with ~1^{o}C offset, corroborating the previous result that the Japan Sea was influenced by Oyashio Current at the time. Using paired $d^{18}O$ and Mg/Ca-derived SST, we have attempted to estimate $d^{18}Osw$ (Oba et al., 1980) and revealed that ~4 permil increase in regional $d^{18}Osw$ took place at 18 to 15 ka. Although $d^{18}Osw$ values are linearly related to salinity , the slope and intercept of $d^{18}Osw$-salinity relation can be changed by evaporation and precipitation fluxes and $d^{18}O$ values of fresh water, resulting in different $d^{18}Osw$-salinity equations in various basins. If the $d^{18}Osw$-salinity relation in the modern Okhotsk Sea ($d^{18}Osw$ = 0.3195 x Salinity - 13.561; Yamamoto et al., 2001) was applied to the early deglacial periods in the Japan Sea, we can roughly estimate paleo-salinity; 24 psu at 18 ka and 33 psu at 15 ka. Given that the source of fresh water for the glacial Japan Sea was the Haung He River, heavier $d^{18}O$ values as an intercept might be appropriate. If so, estimated paleo-salinity at 18 ka will be less than 20 psu. Although the exact estimate of paleo-salinity is quite difficult, the fact that Ba/Ca ratios of planktic foraminifera exhibit a similar trend as the regional $d^{18}Osw$ and very high values up to 2 micromol/mol at 18 ka corroborates that the Japan Sea was severe less-saline surface conditions during the LGM.

Keywords: Japan Sea, Mg/Ca, Ba/Ca, $d^{18}O$

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(May 20-25 2012 at Makuhari, Chiba, Japan)

APE33-22 Room:103 Time:May 24 15:30-15:45

Chemical states and sedimentary records of Lake Baikal sediment.

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Lake Baikal occupies the largest water volume in the world's freshwater lakes, and is located in the eastern part of Eurasian continent. The Lake Baikal sediment contains a detailed record of paleo-environmental changes in the deep continental interior. In this study, we analyzed the abundance of chemical compositions in the sediment core from the Lake Baikal. In addition, to investigate redox conditions in core BSS06-G2, we determined the Mn oxidation state, Mn in the sediment. The sediment Mn oxidation state was determined based on the Mn K-edge x-ray absorption near-edge structure (XANES) spectra captured using a synchrotron radiation beam.From the geochemical evidences, it is suggested that the BSS06-G2 U have almost never mobilized with changes in the post-depositional redox condition. Therefore, distributions of the uranium concentration in sediment can be regarded as a primary sedimentary record of Lake Baikal region and their variations were revealed to synchronize with paleo-environment changes in the North Atlantic Ocean.

Keywords: Lake Baikal, Lacustrine sediment, Uranium, XANES analysis, Paleo-environmental change

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Mid-Holocene paleoenvironmental changes and paleoclimatic changes by solar activity in San'in District, weatern Japan

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Evidence shows that solar activity influences climate on a global scale. In the mid-latitude region, climate change is expected to change precipitation patterns. Concurrently, variation in solar activity may influence phytoplankton productivity. It seems that these changes should be recorded in sediment and organic matter deposits in coastal lagoons. In this study, we discuss the relationship between climate change and solar activity in the mid-Holocene in the northern hemisphere mid-latitude region based on grain size analysis, total organic carbon (TOC) content in coastal lagoon sediment core samples.

The INB core was drilled to produce a high resolution record of Holocene paleoenvironmental change in the San'in District, western Japan. The core is 19.17m in total length and is divided into Unit I-VII by lithofacies. Holocene sediment, primarily organic silt, forms Unit III and above in this core. Unit III was deposited from 8.4 to 5.4 ka, when sea level rose during the Jomon transgression; its depositional environment is a coastal lagoon. Progradation of the river mouth during the sea level rise lead to an increase in the C/N ratio of organic matter. Unit IV contains the volcanic Shigaku pyroclastic flow (the sixth stage of volcanic activity of the Sanbe volcano), and Unit V reflects deposition in a freshwater lake or swamp. Above this aggredational sediments were deposited by small rivers.

This study focused on the coastal lagoon sediments of Unit III (8.4 to 5.4 ka); we carried out CNS elemental analysis and grain size analysis with a resolution of approximately five years. TOC content is variable and increases from 0.5 to 5%. Variation of TOC, TS, C/N ratio and Mean grain size are synchronized, and relatively well correlated with atmospheric radiocarbon 14C (Delta ^{14}C) and therefore with solar activity. But it is seen that phase shift in the lower portion of Unit III. A positive peak of Delta ^{14}C indicating low solar activity and a cold period shows high TOC content because of concentration of TOC. On the other hand, a negative peak in Delta ^{14}C indicates a warm period, and has a low TOC content because of clastic dilution. During the warming climate, the river run-off increased and carried much terrestrial organic carbon with fine clastics and nutrient. Planktonic organic carbon contents of sediments were diluted by the clastics. This trend is also observed in a sediment core of Nakaumi Lagoon in San'in District, where it is due to a dilution effect caused by increased precipitation and high productivity because of a higher nutrient load during a warm interval (Sampei et al.,1997).

Keywords: San'in District, Mid-Holocene, total organic carbon content, Delta ^{14}C, paleoclimatic changes, solar activity

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East China Sea mid-Holocene sea surface temperature reconstructed from Sr/Ca measurements for corals from Kume Island

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The Holocene, a period for the last 11,700 years, is generally recognized as a stable and warm period which sea level has relatively been constant (Yokoyama and Esat, 2011). Growing number of studies, however, have been reported the millennium scale climate changes during this time (e.g., Bond et al., 2001, Wanner et al., 2011), but mechanism of millennium scale climate change has yet to been solved. Particular attention has been paid for the cold episodes during the Holocene and global mapping efforts to understand the natures of events are undertaken (Wanner et al., 2011), yet there are still limitations of spatial and temporal coverages of paleoclimate data. One such an area is the East China Sea (ECS) where the region currently being under influenced from both East Asian monsoon (EAM) and the strength of Kuroshio Current (Sun et al., 2005, Kubota et al., 2010). Various studies based on sedimentary archives have been conducted to reconstruct EAM changes in the past though little efforts are made to produce seasonally resolved longer (ie. $>$ 1,000 years) EAM records.

Coral has annual banding with rapid growth rate like a tree-rings thus it enables us to reconstruct paleoclimate with seasonal time scale. Sr/Ca ratio is a highly reliable indicator of SST amongst various other chemical proxies in their skeleton and being widely used (e.g., Beck et al., 1992). Yet, only study using this method to reconstruct ECS paleoceanography is from Kikai Island using modern and 6 ka corals (Morimoto et al., 2007). The study was not able to provide information for the late Holocene, such as 3 to 4 ka.

In this study, fossil corals were collected from Kume Island, Okinawa, and analyzed both radiocarbon and Sr/Ca ratio to reconstruct mid- to late-Holocene paleoceanography. Two fossil corals (3.8 cal kyr BP and 4.5 cal kyr BP) are obtained and are revealed as pristine since they met the rigorous screening criteria of diagenesis based on XRD and SEM analyses. Two modern corals were collected from Sesoko Island, also located in Ryukyu Islands, to establish the equation of Sr/Ca-SST.

Reconstructed SST in 3.8 cal kyr BP showed colder condition than today ($p<0.01$). This might be corresponding to the cold event previously reported as PME (Pulleniatina minimum event) in ECS (e.g., Xiang et al., 2007; Ujiie et al., 2003). They also suggested that magnitude of those changes were not comparable between summer and winter during the Holocene. Further analyses of coupled Sr/Ca and oxygen isotopes will allow us to separate both SST and salinity and hence can provide detailed information of ECS paleoceanography.

Keywords: East China Sea, East Asian Monsoon, coral, Holocene, Sea Surface Temperature, Sr/Ca

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Rapid sea-level changes and routing of meltwaters during the termination I

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Sea level rise had been occuerred as much as 130 m since the last glacial maximum (LGM) centered around 20,000 years ago. Advancement of geochemistry as well as geophysics allow us to depict detailed pictures of interactions among climate subsystems and the timing of sea-level changes have been synchronous with those changes. In this presentation, I will review recently updated sea-level records for the last 20,000 years and discuss linkages with global climate changes.

Keywords: Paleoclimatology, Paleoceanography, Sea level, Ice Sheets, Antarctica