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

ACG034-P01 Room:Convention Hall Time:May 27 14:00-16:30

A Fundamental Study on paleoclimate reconstruction using tree-ring of Teak

Sasuke Breen[1], Yumiko Watanabe[1*], Mao Harada[1], Takeshi Nakatsuka[2], Suyako Mizuno[1], Junji Sugiyama[1], Takahiro Tagami[1], Toshitaka Tsuda[1]

[1]Kyoto Univ., [2]Nagoya Univ.

In this study, in order to assess the reliability of various parameters in tree-rings as climate proxies, we performed a systematic comparison between temporal variation of meteorological data (precipitation, relative humidity and hours of sunlight) and those of four parameters (ring width, mean vessel area of earlywood, d13C and d18O) in tree-rings collected from Java Island, Indonesia.

The analyzed Teak sample was collected from a site in Indramayu, West Java, Indonesia. Precipitation records from Indramayu show a large seasonal cycle, which oscillated between a dry season (around May to October) and a wet season (around November to April). Seasonal cycle forms annual growth rings in Teak. The sample was cut down in December of 2003 and was observed 30 of tree-ring, showing that its growth spanned the interval from 1974 to 2003. We investigated the correlations between four parameters of tree-rings and climate parameters during 1974-2004.

In this presentation, we will present the results of relationship between tree-rings parameters and meteorological data. We will also present the results of FT-IR spectrum, d13C and d18O measurements, in order to confirm purified cellulose from tree-rings.

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

ACG034-P02 Room:Convention Hall Time:May 27 14:00-16:30

Basic study of paleoclimate

Mao Harada[1*]

[1]Kyoto University

paleoclimate

Keywords: Tree ring, Oxygen and carbon isotopic ratios

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

ACG034-P03 Room:Convention Hall Time:May 27 14:00-16:30

What controls stable isotopes in precipitation in Okinawa Island

Ryu Uemura[1*], Ryuji Asami[2], Hisashi Kadena[3], Syusaku Yamakawa[4], Maika Minami[4], Keita Yamada[5], Naohiro Yoshida[5]

[1]University of the Ryukyus, [2]University of the Ryukyus, [3]Okinawa pref. Inst. of Healt. and Env., [4]University of the Ryukyus, [5]Tokyo Institute of Technology

Stable isotopes in precipitation are fundamental factors in controlling the oxygen and hydrogen isotope ratios of environmental proxies on land, and provide important clues for interpreting the isotope records in natural archives (such as speleothems and tree rings). However, isotopes in precipitation in mid and low latitudes lands are controlled by many factors. Therefore, present-day observation and understanding of the physical mechanisms are needed for quantitative reconstruction of past climate change. Here, we show the stable isotope ratio of precipitation in Okinawa Island, Japan. Precipitation samples were collected at the roof of the Okinawa prefectural institute of health and environment (26 11'11N, 127 45'13E). We measured the hydrogen and oxygen stable isotope ratios of the past 2-year samples. The monthly averaged isotope ratio negatively correlates with relative-humidity and air-temperature. Precipitation amount, which often controls precipitation isotopes in continental region, shows weak correlation. The results imply significant isotope enrichment due to rain re-evaporation in the atmosphere.

Keywords: Stable isotope, precipitation, Okinawa, speleothem

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

ACG034-P04 Room:Convention Hall Time:May 27 14:00-16:30

Subtropical Northwest Pacific Climate Reconstruction from Speleothem Records from Gyokusen-do Cave in Okinawa Island

Ryuji Asami[1*], Ryu Uemura[2], Syusaku Yamakawa[2], Maika Minami[2], Hideko Takayanagi[3], Yasufumi Iryu[3]

[1]University of the Ryukyus, [2]University of the Ryukyus, [3]Nagoya University

A number of Quaternary paleoclimate records have been extracted from various kinds of geological materials such as deep-sea sediments (e.g., Imbrie et al., 1984), ice sheets (e.g., Dansgaard et al., 1993), trees (e.g., Briffa, 2000), speleothems (e.g., Wang et al., 2001), and corals (e.g., Bard et al., 1990). However, high-resolution, accurately dated hydrologic records from the lower latitudes are relatively scarce. Speleothems can have continuous deposition of calcium carbonate over long periods of time and well-chosen speleothems are datable with high precision using U/Th dating methods. Since the 1960s, oxygen isotope signatures in speleothem carbonates have been used as a paleoclimate proxy (e.g., Broecker et al., 1960) because the isotopic values can be controlled by the drip water and the cave temperature (e.g., Hendy, 1971). Recently, speleothem-derived oxygen isotope time series have been widely used to reconstruct hydrologic variations during the Quaternary (e.g., Wang et al., 2001). However, most of previously published archives from speleothems are restricted to China and Europe.

Here, we present oxygen isotope time series of speleothems in Gyoku-sen-do Cave, located at the southern Okinawa Island, Japan. The Hendy test performed in this study suggests that the oxygen isotope profile is primarily of environmental origin without effects of kinetic fractionation. Since December of 2009, we have observed cave environments using loggers and collected water samples. Using the established relationship between oxygen isotope compositions of drip water and precipitation, we provide a speleothem-based reconstruction of hydrologic changes around the Ryukyus for selected time windows during the Quaternary. Coupled with speleothem records from China (e.g., Wang et al., 2001) and Japan (Shen et al., 2010), the present study can allow a better understanding of spatial variations in precipitation associated with East Asian Monsoon for the past.

Keywords: limestone cave, speleothem, oxygen isotope composition, Okinawa, subtropical environment

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

ACG034-P05 Room:Convention Hall Time:May 27 14:00-16:30

Transport and diagenesis of terrestrial higher plant terpenoids in suspended particles from several rivers of Hokkaido

Ken Sawada[1*], Takayuki Sawai[1], Osamu Seki[2]

[1]Faculty of Science, Hokkaido University, [2]Instit. Low Temp. Sci., Hokkaido Univ.

Marine and lacustrine sediments can be useful as geological samples from which long-time scale (more than several 100 thousands years) terrestrial environmental information is successively recorded. However, the terrigenous matter that had information of environment and ecosystem in provenance are transported from land area to ocean and lake, and deposited as allochthonous matter in marine and lacustrine sediments. During the transport and deposition processes, such matter must be chemically and morphologically altered, and also, the records for environment and ecosystem in provenance are possibly changed. Thus, it is important for reconstructing the terrestrial paleoenvironment and paleoecological aspects to examine the alteration or consistency for terrestrial records during those processes. In this study, we focus terrestrial higher plant biomarkers such as terpenoids, in which structures vary depending on taxonomical differences. We analyzed the terrestrial higher plant terpenoids (HPTs) in suspended particles from waters in six rivers (Bekanbeushi, Ishikari, Kushiro, Saru, Teshio, and Tokachi Rivers) of Hokkaido, to evaluate transport and diagenetic processes of higher plant-derived organic materials, and to examine for spread of vegetation and terrestrial environmental records from provenance to ocean.

We identified angiosperm HPTs such as betulnic acid, friedelin, oleanolic acid, and ursonic acid and gymnosperm HPTs such as dehydroabietic acid from suspended particle samples from waters in six rivers of Hokkaido. In the Bekanbeushi River, the highest concentrations of HPTs indicate that plant material is efficiently transported from the Bekanbeushi wetland because of less effect for artificial hindrance. In contrast, concentrations of the HPTs in water of the Kushiro River were much lower, which was attributed to artificial hindrance such as change of flow pathway. The ratios of gymnosperm / angiosperm based on HPT compositions were lower in the Bekanbeushi and Kushiro Rivers, which pass through wetlands, but were higher in the Ishikari and Tokachi Rivers, which flow from forests in mountains. These results indicate that low and high gymnosperm / angiosperm ratios reflect conifer-dominant vegetation in forest and herbaceous angiosperm-dominant vegetation in wetland, respectively. From these insights, we will discuss the more detailed implication for preservation of the records of the provenances such as forest and peat in lacustrine and marine sediments.

Keywords: Higher plant terpenoid (HPT), paleovegetation, terrestrial environment, transport process, early diagenetic alteration, spread of vegetation record

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

ACG034-P06 Room:Convention Hall Time:May 27 14:00-16:30

Paleoenvironmental changes in the Sea of Okhotsk over the past 60 kyrs

Osamu Seki[1*], Naomi Harada[2], Miyako Sato[2], Kimitaka Kawamura[1], Akira Ijiri[2], Takeshi Nakatsuka[3]

[1]Hokkaido University, [2]JAMSTEC, [3]Nagoya University

We measured terrestrial plant biomarker (long-chain n-alkanes) in the sediment cores taken from the Sea of Okhotsk to examine paleoclimatic utility of long-chain n-alkanes in marine sediments. This study demonstrates that sedimentary record of n-alkane in the sea has a high potential to provide important complementary paleo-climate/paleo-environmental information. Molecular distributions of long-chain n-alkanes in marine sediments show a typical signature of terrestrial plant wax derived n-alkanes with strong odd carbon number predominance from the last glacial to the present, suggesting a source of long-chain n-alkanes in the Okhotsk Sea sediments has been terrestrial higher plants throughout the time. The down core profiles of concentrations of C25-C35 n-alkanes in XP07-C9 collected from the northwestern site revealed three events of enhanced terrestrial organic matter input during the last deglaciation. The two pronounced events correspond to Melt Water Pulse (MWP) events 1A (14.5-12.5 ka) and 1B (11-6.5 ka). These events possibly linked to increases in river discharge and erosion of submerged continental shelf due to drastic rise in sea level. Down core profiles of molecular distributions of n-alkanes in the Okhotsk Sea sediments significantly vary over the last 25 kyrs, and are similar to that of a peat core sequence in the East Russia and essentially consistent with pollen data from marine and peat core sequences.

Keywords: Sea of Okhotsk, sediment, paleoenvironment, biomarker

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

ACG034-P07 Room:Convention Hall Time:May 27 14:00-16:30

Sea surface temperature changes in the Okhotsk Sea and adjacent North Pacific during the Last Glacial Maximum and deglac

Naomi Harada[1*], Osamu Seki[2], Katsunori Kimoto[1], Yusuke Okazaki[1], Kana Nagashima[1], Akira Ijiri[3], Takeshi Nakatsuka[4]

[1]JAMSTEC, [2]Hokkaido Univ., [3]The Univ. of Tokyo, [4]Nagoya Univ.

We determined sea surface and subsurface temperatures in the Okhotsk Sea during the Last Glacial Maximum (LGM) and the last deglaciation from measurements of biomarker proxies in piston core sediments, which reveal the climate response of this region to global climate changes. During the LGM, alkenone-derived temperatures in the Okhotsk Sea were relatively warm. Warm alkenone-derived temperatures have also been found at many other sites in the western North Pacific and may reflect the shift in the season and depth of biomarker production from early summer and autumn to midsummer because of an expansion of the season of sea-ice cover. During the last deglaciation, alkenone-derived temperatures changed in response to the millennial-scale climate change; from 19?10 kyr BP the main feature was higher temperatures during Heinrich Event 1 (H1; 4.1˜14.2 C) and Younger Dryas (YD; 6˜11.9 C) and lower during the Bolling-Allerod (B-A; 4.8˜11.6 C). The apparent warmer alkenone-derived temperatures during the cold events (H1 and YD) may result from a cause similar to that for the LGM temperatures. Empirical Orthogonal Function (EOF) analysis also indicated a shift in the alkenone production season as the first principal component. The EOF analysis further implied that the alkenone-derived temperature traced the precessional cycle of fall insolation at 45_N and millennial time-scale variability in the North Atlantic. The millennial-scale response of alkenone-derived temperatures was probably related to the equatorward/polarward migration of the westerly jet axis and to the weakened/strengthened Asian summer monsoons resulting in colder and drier or warmer and wetter climates in East Asia, including the Okhotsk Sea.

Keywords: Okhotsk Sea, North Pacific, Alkenone SST, Sediment, LGM, Deglaciation

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

ACG034-P08 Room:Convention Hall Time:May 27 14:00-16:30

Development of a chemical weathering model toward quantification of global weathering rate in the past

Taichi Nozu[1*], Eiichi Tajika[1]

[1]Dept. EPS, Sch. Sci., Univ. Tokyo

Global climate is thought to have been maintained by the long-term balance of CO_2 due to continental silicate weathering and volcanic degassing. The rate of chemical weathering of silicate minerals depends on lithology, temperature, runoff, plant evolution, soil microbial activity, and so on. Although the relationship among the controlling factors of the chemical weathering rate is still an open question, many studies have mentioned the importance of the rate of physical weathering, or erosion, on the chemical weathering rate. Efforts to quantify the chemical weathering rate using numerical models have also been made, but the number of publications in which such kind of process-based models were applied to paleo-environmental study is limited. We try to develop a process-based weathering model which can be applied for investigating roles of chemical weathering in paleo-environmental change through biogeochemical cycle quantitatively on the basis of governing physical, chemical, and biological processes.

Keywords: chemical weathering, process-based modeling