

# Japan Geoscience Union Meeting 2011

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

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ACG034-P01

会場:コンベンションホール

時間:5月27日 14:00-16:30

## チーク年輪を用いた古気候復元の基礎的研究 A Fundamental Study on paleoclimate reconstruction using tree-ring of Teak

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Sasuke Breen<sup>1</sup>, Yumiko Watanabe<sup>1\*</sup>, Mao Harada<sup>1</sup>, Takeshi Nakatsuka<sup>2</sup>, Suyako Mizuno<sup>1</sup>, Junji Sugiyama<sup>1</sup>, Takahiro Tagami<sup>1</sup>, Toshitaka Tsuda<sup>1</sup>

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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,  $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$ ) 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,  $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$  measurements, in order to confirm purified cellulose from tree-rings.

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ACG034-P02

会場:コンベンションホール

時間:5月27日 14:00-16:30

## インドネシア産樹木年輪（スンカイ）を用いた気候復元の基礎研究 Basic study of paleoclimate

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インドネシア産樹木年輪を用いた古気候復元のための基礎研究

キーワード: 樹木年輪, 酸素・炭素同位体比

Keywords: Tree ring, Oxygen and carbon isotopic ratios

ACG034-P03

会場:コンベンションホール

時間:5月27日 14:00-16:30

## 沖縄本島南部における降水同位体比の変動要因 What controls stable isotopes in precipitation in Okinawa Island

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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.

キーワード: 安定同位体, 降水, 沖縄, 鍾乳石

Keywords: Stable isotope, precipitation, Okinawa, speleothem

ACG034-P04

会場:コンベンションホール

時間:5月27日 14:00-16:30

## 沖縄本島南部玉泉洞の石筍を用いた陸域古環境復元 Subtropical Northwest Pacific Climate Reconstruction from Speleothem Records from Gyokusen-do Cave in Okinawa Island

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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.

キーワード: 鍾乳洞, 石筍, 酸素同位体組成, 沖縄, 亜熱帯環境

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

## 北海道の河川懸濁粒子中のテルペノイドを用いた陸上植物由来有機物の輸送・続成過程の研究：植生記録の伝播の検討 Transport and diagenesis of terrestrial higher plant terpenoids in suspended particles from several rivers of Hokkaido

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長時間スケール(数十万年以上)の陸上環境情報を連続的に復元することは、森林土壌などの陸上に存在する試料では稀な例を除いてはほとんど不可能である。しかし、海洋・湖底堆積物は陸上環境記録を連続的に保持する有効な地質学試料となり得る。ただし、後背地の環境や生態系の情報を記録した陸源物質は、陸上から海洋・湖沼へ輸送され、異地性の物質として海底・湖底堆積物に埋積する。その輸送・埋積過程において、そのような物質は化学的・形態的に変質するに違いなく、そして後背地の環境・生態系記録も変化する可能性がある。したがって、陸上の古環境・古生態の復元のためには、それらの過程における陸上記録の変質または不変性を検討することが重要である。本研究では、テルペノイドのような陸上高等植物のバイオマーカーに注目した。高等植物テルペノイド(Higher plant terpenoid: HPT)はその構造が分類の違いによって変化し、化学分類指標としても使われるバイオマーカーである。私たちは、北海道の6つの河川(別寒辺牛川・石狩川・釧路川・沙流川・天塩川・十勝川)の水中から懸濁粒子を採取し、それら試料の陸上植物起源テルペノイドバイオマーカーの分析を行った。この分析により、陸源有機物質の輸送過程、堆積過程におけるバイオマーカーの初期続成作用を評価し、また陸上植物由来有機物質が陸上植生・環境の記録が保持されているかを検討した。

北海道の6つの河川水から得られた懸濁粒子試料から、被子植物由来のベツリン酸、フリーデリン、ウルソール酸、オレアノール酸と裸子植物由来のデヒドロアビエチン酸が高濃度で検出された。別寒辺牛川において河川水中を流れる粒子中のバイオマーカーは、ほぼ人間の手が加わっていない低層湿原をもつという後背地の特徴をよく反映することが確認された。別寒辺牛川と同様に、低層湿原を後背地にもつ釧路川の試料中からは、別寒辺牛川よりもバイオマーカーの検出数、検出量がともに少なかったことは、釧路川の方が流路の変化などより開発が進んだため、河川への有機物質の流入量が少なくなったことが考えられる。HPTから推定した裸子/被子植生比は、湿原を流れる河川である釧路川と別寒辺牛川は低い比を示し、森林を後背地にもつ石狩川と十勝川は高い比を示した。これは湿原で草本の被子植物、森林に針葉樹植生が優勢な植生をよく反映した結果であると考えられる。さらに、これらの知見からの森林・湿原の植生記録が湖底・海底堆積物に保持されているかどうかのより詳細な考察は、講演にて説明する。

キーワード: 高等植物テルペノイド, 古植生, 陸上環境, 輸送過程, 初期続成変化, 植生記録の伝播

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

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ACG034-P06

会場:コンベンションホール

時間:5月27日 14:00-16:30

## 過去6万年間のオホーツク海の環境変動

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

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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.

キーワード: オホーツク海, 堆積物, 古環境, バイオマーカー

Keywords: Sea of Okhotsk, sediment, paleoenvironment, biomarker

## 北西部北太平洋及びオホーツク海における最終氷期最寒期及び融氷期の表層水温変動

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

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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.

キーワード: オホーツク海, 北太平洋, 堆積物, アルケノン水温, 最終氷期最寒期, 融氷期

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

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ACG034-P08

会場:コンベンションホール

時間:5月27日 14:00-16:30

## 全球風化速度の定量化に向けた化学風化モデルの開発

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

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Global climate is thought to have been maintained by the long-term balance of CO<sub>2</sub> 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.

キーワード: 化学風化, 数値モデル

Keywords: chemical weathering, process-based modeling