

# Japan Geoscience Union Meeting 2011

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

©2011. Japan Geoscience Union. All Rights Reserved.



HCG036-01

Room:202

Time:May 24 10:45-11:00

## Current status and issues of grain-size analysis using dynamic digital image method for sediment

Futoshi Nanayama<sup>1\*</sup>

<sup>1</sup>Geological Survey Japan, AIST

Grain-size analysis is fundamental to sedimentology, but despite technological advances in lab instruments, grain-size analysis is still slow and heavy. Most approaches to grain-size analysis of sediment have utilized mechanical sieving, settling through a column of water or laser diffraction. The dynamic digital image analysis is the most efficient method for grain size and particle shape measurement of sediment because of the wide measuring range from silt to pebble size grain at the same time. In this presentation, we would like to review about current status and issues of grain-size analysis using dynamic digital image method for sediment for example data from the Horiba CAMSIZER at Geological Survey of Japan, AIST.

Keywords: current status and issues, grain-size analysis, dynamic digital image method, sediment, particle shape

HCG036-02

Room:202

Time:May 24 11:00-11:15

## Pleistocene forearc sedimentation during active uplift of the Japanese South Alps

Kosuke Egawa<sup>1\*</sup>, Kiyofumi Suzuki<sup>1</sup>, Osamu Takano<sup>2</sup>, Toshiko Furukawa<sup>3</sup>

<sup>1</sup>MHRC/AIST, <sup>2</sup>JAPEX-RC, <sup>3</sup>JOGMEC

The South Alps of Japan or Akaishi Mountains has been rapidly uplifted from ca. 1 Ma due to subduction of the Philippine Sea Plate underneath the Eurasian Plate and related collision of the Izu-Ogasawara arc with the main island of Japan. Synchronously with this rapid uplift, depositional environments in forearc basin around the South Alps largely varied. Previous sedimentological studies in both onshore and offshore fields (Muto, 1985, *J. Geol. Soc. Japan*; Saito and Masuda, 1996, *Sedi. Geol.*; Takano et al., 2009, *J. Geograph.*) described that the Lower Pleistocene Kakegawa Group was deposited with distinct marine transgression, followed by sedimentation of the Middle Pleistocene Ogasa Group that unconformably covers the underlying Kakegawa Group with significant submarine fan progradation. In this contribution, three-dimensional seismic reflection interpretation in off Tokai area reveals that (i) the Kakegawa Group became folded under compressional stresses after its deposition and subsequent unconformable covering of the Ogasa Group occurred on the folded Kakegawa Group, and (ii) the lower and upper sequences of the Ogasa Group have sediment waves showing north-northeasterly and northwesterly paleocurrent directions, respectively. Based on these new results, we discuss how the Pleistocene forearc basin in off Tokai area was filled during active uplift of the South Alps. This contribution is a study as part of MH21 Research Consortium.

Keywords: Off Tokai area, Pleistocene forearc basin, Kakegawa Group, Ogasa Group, compressional folding, sediment wave

# Japan Geoscience Union Meeting 2011

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

©2011. Japan Geoscience Union. All Rights Reserved.



HCG036-03

Room:202

Time:May 24 11:15-11:30

## Decrease of continental weathering in the Early Triassic in the Tethyan Himalaya, central Nepal

Kohki Yoshida<sup>1\*</sup>, Toshio Kawamura<sup>2</sup>, Shigeyuki Suzuki<sup>3</sup>, Megh Raj Dhital<sup>4</sup>

<sup>1</sup>Faculty of Science, Shinshu University, <sup>2</sup>Miyagi University, <sup>3</sup>Okayama University, <sup>4</sup>Tribhuvan University

The geochemistry of mudstones to estimation for continental weathering in the central area of Nepal, Tethyan Himalaya, present the key of the Early Triassic climate change, around early Olenekian (Smithian). High value of chemical weathering indexes in the Griesbachian - Dienerian are sharply decreased from the late Dienerian to middle Smithian, which suggests the climatic episode characterized by abrupt decrease of continental weathering suggesting predominance of arid or cool climate. Because the contemporaneous radiation of ammonite fauna was reported previously, presented arid or cool climate episode indicates that the large climatic change could be one of the important controls in Early Triassic environment. The climatic change is considered to contribute to emerge from "super hot house" subsequent from the duration of Permian - Triassic boundary aftermath.

Keywords: Triassic, continental weathering, climatic change

HCG036-04

Room:202

Time:May 24 11:30-11:45

## Organic geochemical aspects of hyperpicnite-like sedimentary sequence in the Neogene Kawabata Formation, Hokkaido, Japan

Satoshi Furota<sup>1\*</sup>, Ken Sawada<sup>1</sup>, Gentaro Kawakami<sup>2</sup>

<sup>1</sup>Faculty of Science, Hokkaido University, <sup>2</sup>Geological Survey of Hokkaido, HRO

The Neogene Kawabata Formation, which is located in Yubari area of central Hokkaido, is characterized by turbidite facies that consist of alternations of conglomerate, sand, and mud stones. The Ishikari Trough has been formed with N-S direction in Central Hokkaido region during 15 Ma in the Middle to Late Miocene. The Kawabata Formation is thick sediments filled with the Ishikari Trough. We perform sedimentological and geochemical investigations of the Kawabata Formation, in order to give understandings for transport and sedimentation of terrigenous materials as well as material cycling in neritic to hemipelagic environments. In this presentation, we focus organic geochemical results in the hyperpicnite-like sedimentary sequence described in the Kawabata Formation. Furthermore, we discuss the biogeochemical interaction between land and ocean such as the relationship between higher marine primary production and efficient transport of terrigenous materials by flood system.

We discovered a peculiar sedimentary sequence across about 50 cm depths in an outcrop of the Higashiyama-gawa route in Yubari. This sedimentary sequence consists of homogenous mudstone, coarsening-upward sandstone, sandstone intercalated thin layers of plant fragments, sandstone randomly contained plant fragments, fining-upward sandstone, sandstone with horizontal lamination, and homogenous mudstone, from lower to upper layers. This sequential pattern is almost similar to that in hyperpicnite. Total organic carbon content (TOC; %) was found to increase remarkably from sandstone layers with plant fragments to horizontal lamination layer, which is concordant with hyperpicnite (Yoshida et al., 2009). Organic geochemical characteristics for biomarker were followings, 1) concentrations of coniferous biomarker were remarkably higher in homogenous mudstone below the sandstones and coarsening-upward sandstone, 2) concentrations of degraded biomarkers originated from angiosperm were higher in sandstone layers with plant fragments, and 3) maturity levels were significantly lower in sandstone layers with plant fragments. From these results, we conclude that this sedimentary sequence was hyperpicnite. Furthermore, we found that concentrations of biomarkers derived from marine phytoplankton remarkably increased with increasing those of terrigenous biomarkers in homogenous mudstones above the sandstones. This fact suggests that marine primary production was activated by efficient transport of terrigenous materials by flood system in the Ishikari Trough during Late Miocene. These results are important for understanding material cycling and biogeochemical processes with Neogene-order time scale.

Keywords: Neogene paleoceanography, Sedimentary system, Hyperpicnal, Land-ocean interaction, supply of terrigenous material, material cycling in neritic environment

# Japan Geoscience Union Meeting 2011

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

©2011. Japan Geoscience Union. All Rights Reserved.



HCG036-05

Room:202

Time:May 24 11:45-12:00

## Age estimation of a turbidite layer in surface deposit of the Enshu Trough, off-Tokai district

Masaaki Shirai<sup>1\*</sup>, Takuma Ito<sup>2</sup>, Yuichi Niwa<sup>3</sup>, Akiko Omura<sup>3</sup>, Toru Wakabayashi<sup>3</sup>

<sup>1</sup>Tokyo Metropolitan Univ., <sup>2</sup>Nagano City Museum, <sup>3</sup>Univ. of Tokyo

Tokai district, central Japan is located near the Nankai-Suruga Trough and has been attacked by the Tokai earthquakes repeatedly. These earthquakes often induced submarine landslides and formation of turbidites. A 7 cm-thick distinct turbidite layer was intercalated in the surface hemipelagite obtained from the Enshu Trough at 1500m water depth. Although mass accumulation rate (MAR) of hemipelagic component and age of the sand layer were estimated based on dry bulk density, grain size distribution, and depth of Cs-137 appearance horizon, enough accuracy of age estimation was not obtained due to shallow position of appearance horizon and low activity of Cs-137. We compare result of new estimation of depositional age of the turbidite using Pb-210 dating with the Cs-137 using estimation.

Keywords: turbidite, hemipelagite, Pb-210 dating, Cs-137, Anse-Tokai Earthquake

HCG036-06

Room:202

Time:May 24 12:00-12:15

## Effect of the storm waves on the distribution of sediments on the reef at northern Ryukyu Islands

Satoko Ikema<sup>1\*</sup>, Kazuhisa Goto<sup>2</sup>, Kunimasa Miyagi<sup>3</sup>, Koji Minoura<sup>1</sup>, Fumihiko Imamura<sup>4</sup>

<sup>1</sup>Graduate School of Science, Tohoku Univ., <sup>2</sup>Chiba Institute of Technology, <sup>3</sup>Ishigaki Island Meteorological Observato, <sup>4</sup>Graduate School of Engineering, Tohoku U

Coral reefs form dynamic wave-resistant structures built by the skeletons of living organisms, and absorb the energy of breaking waves that are produced by storms and tsunamis. Because the most active growth is in the wave-breaking zone, reefs form linear structures facing waves, often parallel to shorelines, protecting them from erosion. Only scleractinian corals are able to build these structures. Storm surge in the Ryukyu Islands is the abnormal rise in water level caused by wind and pressure forces of a typhoon. Coral reefs are subject to mortality from a variety of wave erosion whose impact is most serious at reef edges, and removed reef blocks are transported them as boulders to the reef flat by shoring currents.

Coral boulders or cobbles without mechanical abrasion and smoothing are generally found on reef flats in the Ryukyu Islands. No large tsunamis have attacked the northern Ryukyu Islands for the last 200 years and hence they were highly likely deposited by the storm waves. Although previous works focused on the distribution of boulders (Goto et al., 2009) or cobbles (e.g. Kan et al., 1994), there is no systematic study that investigated the characteristics and distribution of the reef sediments (sand to boulder size) transported and deposited by storm waves. Thus, we investigated the sediment distribution on the reef and compared to the distribution of the storm wave forces.

Field work was conducted in the Yo coast, north-eastern Amami-Oshima Island of Kagoshima Prefecture. Boulders deposited on the reef crest, distributed within 200 m from the reef edge as an exponentially fining landward deposit. Although Amami-Oshima Island is about 300 km far from Okinawa Islands, central Ryukyu Islands, the boulders were commonly deposited on the similar distribution trend. This suggests that storm waves which have attacked to these islands on the Pacific Ocean side were similar in the maximum intensities, and that the landward limit of boulders might be estimated as the maximum transport force of storm waves. The bottom sediments at the landward half of the moat were composed of coral sands, whereas offshore half of the moat is composed of Sargassum, rubbles and gravels. Reef rocks were exposed on the floor of the reef crest, and many coralline boulders with >1 m in long axis were deposited. We found that maximum sizes of the sediments on the reef of Yo coast shows exponentially fining trend with distance landward from the reef edge. This trend is well consistent with the distribution of the storm wave force on the reef. Therefore, we infer that the storm wave force is one of the major factors to determine the sediment distribution on the reef.

Keywords: Amami-Oshima, coral reef, boulder, reef sediments, storm wave

HCG036-07

Room:202

Time:May 24 12:15-12:30

## Correlation of tsunami deposits based on temporal change in coastal environment, eastern Hokkaido

Yugo Nakamura<sup>1\*</sup>, Yuichi Nishimura<sup>1</sup>, Andrew Moore<sup>2</sup>

<sup>1</sup>ISV, Hokkaido University, <sup>2</sup>Earlham College

Because Hokkaido and the Kuril Islands lack an extensive historical record, geologic studies of paleotsunami deposits are the most reliable method of estimating the frequency and magnitude of past tsunami events in this area.

Eight sand layers in 3000 years of coastal deposition on the eastern coast of Hokkaido provide the best evidence for frequency and magnitude of the tsunami hazard faced by this area. However, correlation of these sand layers from one location to the next, or even within one location, is difficult?the regional tephra stratigraphy provides poor resolution for the time of interest, and radiocarbon also often fails to provide adequate resolution. Here we couple mineralogical analysis of the deposits with high-resolution granulometry to provide another tool for correlation on this coast.

Paleotsunami deposits are often correlated based on thickness, depositional structures, tephrochronology, and radiometric dates. In this area, however, the depositional environment (a hummocky marsh) creates microtopography that makes both thickness and depositional structures unusable for large-scale correlation. The available marker tephra in the area are: Tarumae-a tephra (Ta-a, AD1739), Komagatake-c2 tephra (Ko-c2, AD1694), Tarumae-b tephra (Ta-b, AD1667), Baekdu-san Tomakomai tephra (B-Tm, ~1000 yr BP), and Tarumae-c tephra (Ta-c, ca. 2700 yr BP). These are insufficient for chronology before the 17th century. Equally, with approximately one layer every 350-400 years, even radiocarbon often cannot provide adequate resolution to be used for correlation of these sand units.

In this study we attempt to correlate sand layers using particle size distribution, diatom assemblages, and the chemical composition of volcanic glass and orthopyroxene. Particle size distributions vary with layer and subunit depending on hydraulic conditions and on source material. Sand layer composition also varies with source material. In particular, pumice and orthopyroxene can be used to infer different source areas on this coastline. Diatom assemblages can also be used to help explain the source of the sand.

We sampled sand layers in two marshes, near Urahoro and Nemuro, using a Geoslicer. Particle size distribution within each layer was measured with a Retsch Camsizer. Minerals and diatoms were identified under a light microscope. Major element composition of volcanic glass and orthopyroxene was determined with an EDS.

Near Urahoro, eight tsunami layers (U-1 to U-8) occur between Ta-b and Ta-c. Four layers (U-1, U-2, U-5, and U-8) can be correlated by their particle size distribution. Depositional structures vary greatly in the area, probably because of microtopography. U-1 is distinguishable from others by the presence of orthopyroxene, possibly suggesting that U-1 was deposited during a different season. Sand samples taken from inland sites contain more pumice fragments than samples from seaward sites, suggesting density separation during transport.

In Nemuro, one tsunami layer (N-1) occurs above Ta-a, and seven layers (N-2 to N-8) between Ko-c2 and Ta-c. Tsunami layers contain 90% freshwater diatoms and 5-10% brackish, indicating that the tsunami waters originated from the diatom-poor sea and flowed through brackish and freshwater areas. Younger layers contain more marine and brackish diatoms, suggesting land subsidence or coastal erosion.

Precise particle size distributions and compositional analysis strengthen the correlations of tsunami layers. Grain materials and diatom assemblages enable interpretation of tsunami deposit source and the geological and hydrological setting at the time of the tsunami.

Keywords: Tsunami deposits, correlation, particle size distribution, grain materials, Kuril Trench