Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HCG35-P01 Room:Convention Hall Time:May 27 18:15-19:30

Automatic identification and statistical characteristics of annual layers in stalagmites

SASAKI, Hana[1*] ; ISHIHARA, Yoshiro[2] ; YOSHIMURA, Kazuhisa[3] ; ONISHI, Yuri[2]

[1]Graduate School of Science, Fukuoka University, [2]Department of Earth System Science, Fukuoka University, [3]Faculty of Sciences, Kyushu University

Records of chemical and isotopic compositions of stalagmites, such as Mg/Ca, and carbon isotope ratios, provide various kinds of paleoenvironmental details, for instance, information related to changes in vegetation and solar cycles. Annual layers recognized in stalagmites are also used as an age proxy for paleoenvironmental information. These layers are mainly formed by annual changes in the impure materials incorporated within the layers, and in some layers, it is possible to use ultraviolet rays to observe fluorescent impurity materials such as fulvic acids. It has been concluded that the process of formation of annual layers in stalagmites is deeply related to the following: the sedimentation rate affected by the rate of dripping water, the calcium ion concentration in that water, the form of the stalagmite, the carbon dioxide concentration in caves, and the surface environmental changes affecting fulvic acid production. However, a number of unsolved problems remain related to the ways in which these factors affect the thickness of an individual annual layer and the fluorescence intensity.

When using annual layers in stalagmites as an age proxy, the sedimentation rate during specific intervals is estimated from the average thicknesses of these layers. If the sample includes indistinct layers, their adjacent upper or lower section data are used. However, the frequent use of microscopes in performing annual layer counts and thickness measurements in stalagmites is associated with problems of reproducibility. Therefore, establishment of a method for objectively and quantitatively measuring annual layers in stalagmites that includes statistical analysis, as is strongly suggested in paleoenvironmental studies, would improve data reliability. In this study, an automatic measuring method developed for lacustrine varved diatomites was applied to annual layers in stalagmites, and statistical analyses were performed on the measurement results.

Annual layers in stalagmites were photographed using a fluorescence microscope. Identification and measurement of annual layers in digital images were performed using the method proposed by Sasaki et al. (in press). The procedure used for identifying and measuring annual layers using this method was as follows: (1) the gray values in the images were smoothed, and the change rates of these values were calculated, (2) the median values of the smoothed gray values in a moving window were calculated, (3) the annual layers were identified based on combinations of the maximum change rate in (1) and the median value in (2). After identification of the annual layers, their thicknesses were measured at boundaries of the identified layers.

The results suggest that the automatic identification method developed for lacustrine deposits can be applied to the annual layers of stalagmites. An asymmetrical stratigraphic variation of the fluorescence intensity, which can be related to the formation process of the layer, was observed within a layer of stalagmites. The thicknesses of the layers and their average fluorescence intensities have a wide range of values, even in the short term, so their time series fluctuate considerably. In an example of annual layers in a stalagmite obtained in Ryuo-do Cave in Saikai City, Nagasaki Prefecture on Kyushu Island, the following was found: a wide range of the normal thickness frequency distribution or an approximately lognormal thickness frequency distribution with a range of approximately 50-200 micrometer; an increasing fluorescence intensity in each layer from the lower to upper part; and a fluctuation of the fluorescence intensity in layers unrelated to the fluctuation of the layer thicknesses. The results suggest that the formation process of the annual layers is highly affected by the cave environment, and thus further study involving direct observations of the formation process of annual layers on stalagmites is indicated.

Keywords: annual layer, image analysis, stalagmite, time series analys

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HCG35-P02 Room:Convention Hall Time:May 27 18:15-19:30

Formation condition of deposits of sediment wave in the Neogene Aoshima Formation, Kyushu Island, southwest Japan

ISHIHARA, Yoshiro[1*] ; ONISHI, Yuri[1] ; KAWAKAMI-TAKII, Kiwako[1]

[1]Department of Earth System Science, Fukuoka University

The Neogene Aoshima Formation, the uppermost part of a forearc basin fill of the Miyazaki Group, is well exposed along the Nichinan Coast, in Miyazaki City, Miyazaki Prefecture. Sediment gravity flow deposits dominate this formation, showing anomalous depositional sequences and thickness frequency distributions. The sediment gravity flow deposits are well correlated along the palaeocurrent directions of the formation. These deposits, 10 cm to 30 cm thick, are traceable for about 10 km along outcrops exposed at the coast. Sedimentary facies and statistical analyses of the bed thicknesses suggest an offshore depositional setting of a fan delta.

In the formation distributed along the Shirahama Coast of Miyazaki City, bed-by-bed correlations of the sediment gravity flow deposits along approximately 700 m have been performed in our previous studies. In those results, the depositional topography with a wavelength of approximately 600 m to 700 m suggested a sequence of sediment waves. In the present study, we calculated flow velocities of the sediment gravity flows forming the sediment waves and compare the consistency with sedimentary structures in the sediment gravity flow deposits forming the waves.

The sediment wave deposits in the Aoshima Formation have the following characteristics. (1) The beds of the sediment gravity flow deposit are composed of fine- to medium-grained sandstone. Lateral thickness fluctuations are dominant in the upper part of the analysed section. (2) Waves showing wavelengths of approximately 600 m to 700 m have short stoss sides and long lee sides. (3) The intervals of beds in the stoss sides frequently contain many rip-up clasts. (4) The dominant sedimentary structures in the sediment gravity flow deposits forming the waves exhibit spaced planner laminations and massive units. These characteristics suggest that the deposits forming the sediment waves were deposited in an upper flow regime stage and that hydraulic jumps occurred in the intervals of the stoss sides.

The flow velocities of the sediment waves were calculated by examining the relationship between the wavelength and flow velocity of the sediment wave in previous studies. In the calculation, the density difference in the ambient fluid and sediment gravity flow was 10 kg/m^3 to 300 kg/m^3; deposition-dominated flows that were not included in auto-suspension were considered. The results indicate flow velocities of 3.0 to 17.3 m/s with a palaeoslope of 0.1 degree, 3.0 to 13.0 m/s in 1 degree, 3.0 to 6.5 m/s in 2 degree, and 3.0-4.3 m/s in 5 degree. These estimated flow velocities correspond to the sedimentary structures in the upper flow regime stage in the sediment gravity flow deposits forming the sediment waves.

Keywords: sediment wave, traction carpet, sediment gravity flow deposit, bed-by-bed correlation, flow velocity

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HCG35-P03 Room:Convention Hall Time:May 27 18:15-19:30

Facies analysis of turbidite succession using borehole log data

ONISHI, Yuri[1*] ; SASAKI, Hana[1] ; ISHIHARA, Yoshiro[2] ; TAKANO, Osamu[3]

[1]Graduate School of Science, Fukuoka University, [2]Department of Earth System Science, Fukuoka University, [3]Japan Petroleum Exploration, JAPEX Research Center

Gamma-ray logging is regarded as the most sensitive method to lithofacies changes in boreholes. For this reason, identifications of lithofacies in turbidite successions along a well-log succession are made mainly based on gamma-ray logs. Gamma-ray logs are also analyzed using software, e.g, CycloLog^{TM} for spectral analysis of gamma-ray logs, to detect sedimentary facies and stratigraphic variations, because the resolutions of the log data are limited for certain data intervals and the identifications are necessary for objective interpretations. Such tools can be used to easily and objectively detect sandy or muddy horizons, estimate scales of stratigraphic variations, and discover correlations in the log data. In this study, in particular, sedimentary facies was analyzed using the lamina identifying method proposed by Sasaki et al.(in press) and the Hurst analysis procedure using gamma-ray log data from turbidite successions.

The method of Sasaki et al. can provide reproducible and objective lamina boundary identifications by use of a combination of change rates with median values from the gray-value profiles of digital lamina images. Because the method can identify bicolored laminae, it was used for identifying intervals of sandstone-dominated and mudstone-dominated horizons in the logs. The Hurst analysis can reveal the fractal nature of log data, and these data can be used to further characterize each unit of the horizons identified by the method of Sasaki et al.

In the results, high and low-density sandy intervals and high and low-density muddy intervals were identified using the above methods on the density logs (e.g., RHOB) from the gamma-ray log data. The Hurst analysis evaluated persistence, and the results suggest that fluctuations in ”real” alternations affected the log-patterns of the intervals. It is suggested that corroboration of the results from these methods can provide a new kind of robust sedimentary-facies analysis for turbidite succession.

Keywords: sedimentary facies analysis, turbidite succession, Hurst analysis, gamma-ray log

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HCG35-P04 Room:Convention Hall Time:May 27 18:15-19:30

Three-dimensional models of alluvial plain considering sedimentary facies: an example of Kumamoto Plain

NAKAO, Kento[1*] ; ISHIHARA, Yoshiro[1] ; NARUSE, Hajime[1]

[1]Department of Earth System Science Faculty of Science, Fukuoka University, [2]Department of Geology and Mineralogy, Graduate School of Science, Kyoto University

Most alluvial plains in Japan are located in oceanfront areas, which are areas of high population density. Recent studies of alluvial plains have focused on the construction of three-dimensional geological models and geotechnical maps in these areas because such regions include geotechnically soft ground. Eto et al. (2008) constructed three-dimensional geological and geotechnical models of incised-valley fills beneath the Tokyo Lowland by using a method that requires neither an expert interpretation nor specialist knowledge. Although evaluation of lithologic continuities should be included in the construction of such models, this factor has not been considered in previous studies. Continuities of lithology are strongly affected by the sedimentary processes represented in the sedimentary facies. Therefore, three-dimensional models considering sedimentary facies will lead to improvements in model accuracy.

The Kumamoto Plain distributed in the Kumamoto Prefecture, Kyushu Island, is located in a downstream area of the Shirakawa and Midori-kawa rivers originating from the Aso Caldera. Alluvial deposits in this area include the Shimabarakaiwan Formation and the Ariake Clay Formation in ascending order. Lithofacies of the Holocene Ariake Clay Formation include channel-fills and flood plain deposits of an inland bay area and coastal delta deposits in Shimabara bay (Hase and Iwauchi, 1996). In this study, we characterized the lithological distributions of the alluvial deposits by analyzing borehole data in the Kumamoto Plain, and we applied an improved construction method of a three-dimensional geological model to the alluvial deposits. As a result, the Ariake Clay Formation well continuing from the bay to the inland areas is clearly visualized.

Keywords: alluvial plains, borehole database, continuities of lithology, The Kumamoto Plain, sedimentary facies, three-dimensional geological model

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HCG35-P05 Room:Convention Hall Time:May 27 18:15-19:30

Subsurface structure around Oumi basin

KITADA, Naoko[1*] ; ITO, Hiroko[1] ; INOUE, Naoto[1] ; MITAMURA, Muneki[2] ; TAKEMURA, Keiji[3]

[1]Geo-Resarch Institute, [2]Osaka City Univ., [3]Kyoto Univ.

Omi Basin is located in the central part of Shiga Prefecture which includes the largest lake in Japan called Lake Biwa. So as to clarify both geotechnical and geological properties in this area, Kansai Geo-informatics Network (KG-NET) has collected about 14,600 borehole data to add the exiting ”Kansai Geo-informatics Database”(GI-base). In this study, the sedimentary facies of the shallow subsurface strata have been introduced by using GI-base and some standard borehole data.

Because the topographical and geological characteristics of the basin obviously change for each local area, the sedimentary facies are also complicate and difficult to be generally evaluated. So the discussion has been focused about mainly the eastern and western part of Lake Biwa.

The eastern part of Lake Biwa has the largest plain in the Basin. The freshwater clays distribute continuously under the deltaic deposit in the southeast, while the beach ridge and its back marsh are formed along the northeast lakeside. The soil properties of the reclaimed lagoons and back marsh are specially soft and weak clays.

Keywords: alluvium, borehole, database, sedimentary environment

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HCG35-P06 Room:Convention Hall Time:May 27 18:15-19:30

Chemical composition and classification of frutexites in Alwa Formation, Oman mountains, northern Oman

HONJO, Ren[1*] ; YOSHIDA, Kohki[2]

[1]Graduate school of science and technology, Shinshu University, [2]Department of Geology, Faculty of Science, Shinshu University

The frutexites, showing irregular shrub structure, which was described as a micorostromatolites induced by microbial activity by Maslov (1960). The structure with microlayering is interpreted to be formed by microbiotic activity with deposition of Fe and Mn minerals (Jakubowicz et al., 2014). The frutexites were reported from the Lower Triassic Alwa Formation, which is distributed in the southeastern part of the Oman Mountains (Woods and Baud, 2009). This formation consist mainly of red colored carbonate including peloidal wakestones and perodial packstones. The frutexites is occurred from the remarkable black colored carbonate, which is called as sheet crack by Woods and Baud (2009) and is filled by submarine cement in the Alwa Formation. This black colored carbonate encrusts the wall-rock surface of sheet crack. In this study, we aim to describe the microstructure and chemical composition of this frutexites on the basis of microscopic observation and chemical analysis using EDS.

The predominant feature of the frutexites in the Alwa Formation exhibits 0.1-1.5mm long shrub structure consisting of microlayering by Fe-Mn rich carbonate minerals. Under microscope, two distinct layers showing orange and white colors are recognized and the latter is developed in outer marginal layer of the shrub structure of these carbonate microlayers. In addition, the black color shrubs, which are 0.1-0.5mm long and lack to orange colored layers, are also observed in the black carbonate.

The EDS analysis, using JSM-6510A in Shinshu University, shows the compositional difference of the micro layers of these frutexites. The orange and white colored microlayers of frutexites contain Mg, Fe, Mn as a carbonate component, whereas Al and P concentrates in the black colored microlayers. Thus, the frutexites in the Alwa Formation is classified by two types; Mg-Fe-Mn rich and Al-P rich types. The shrub structure grew as a result of mineralization by microbial activity under fluctuating conditions (Jakubowicz et al., 2014). Thus, this compositional differences and variety of frutexites is possibly related to the microbial activity and bottom water condition during their growth stage.

Keywords: Triassic, limestone, chemical composition, Oman

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HCG35-P07 Room:Convention Hall Time:May 27 18:15-19:30

Special differences of regressive systems during MIS 5e-4 in the Pleistocene Kioroshi and Joso Formations, Shimosa Group

AKIYAMA, Daichi[1*] ; NAKAZATO, Hiroomi[2] ; OKAZAKI, Hiroko[3]

[1]Graduate School of Frontier Science, The University of Tokyo, [2]National Institute for Rural Engineering, [3]Division of Earth Science, Natural History and Institute, Chiba

Paleo-Tokyo Bay, which the Middle to Upper Pleistocene Shimosa Group was deposited in, repeated appearance and disappearance under the condition of glacio-eustatic sea-level change, Kanto plain. The upper part of the Shimousa Group consists of Kioroshi and Joso Formations, which were deposited during marine oxygen-isotope stage (MIS) 6 to 4. This study analyzed sedimentary facies of the typical regressive systems developed at the inner part of bay and the open sea side, in Kioroshi and Joso Formations, which is distributed the Joso Upland , in southern Ibaraki and northern Chiba Prefectures. As the result, lower shoreface, upper shoreface, tidal inlet, beach, and marsh facies are recognized in the Kioroshi Formations. River and marsh facies are recognized in the Joso Formation. Although similar sedimentary facies are recognized, the inner part of bay and the open sea side have differences in their facies and grain size distributions. Fluvial facies of the inner part of bay consists of mud to pebble, very poorly sorted. Large-scale trough cross-stratification is the predominant sedimentary structure. It shows typical river facies. On the other hand, facies of the open sea side consists of mainly medium-grained to coarse-grained sand, well sorted comparison with the facies of the inner part of bay, and the constituent parts of mud is several percent. Trough cross-stratification shows small-scale, and the iron sands is concentrated into laminae. Such as differences of facies reflect special differences the paleogeography, during the regression. However, the cronocorrelation is needed to reconstruct about the paleogeography.

Keywords: regressive systems, Middle to Upper Pleistocene, Paleo-Tokyo Bay