

HCG036-P01

Room:Convention Hall

Time:May 24 14:00-16:30

## Sr-Nd isotopic signatures indicate the provenance and depositional process of loams in the Tottori coastal dune

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Isotopic analyses of strontium and neodymium suggest that layers of loam intercalated in dune sand on the Japan Sea coast at Tottori, western Japan, mainly consist of Asian dust particles from China. An outcrop exposure shows a succession of late Pleistocene dune sand, a lower loam layer, Daisen-Kurayoshi Pumice (DKP; 50~55 ka or older), an upper loam, Aira-Tn tuff (c. 30 ka), and Holocene dune sand, in ascending order. Bulk samples of the loam layers show an upward increase in  $^{87}\text{Sr}/^{86}\text{Sr}$ , suggesting that the contribution of Asian dust increases upward. The Sr isotopic values also suggest a greater contribution of Asian dust in the silt fraction than in the bulk sample. Asian dust transported by westerly jet from the Taklamakan or Gobi desert is the main constituent of the upper part of the lower loam, of which isotopic values of silicate portion is isotopically identical to those of those desert sand ( $^{87}\text{Sr}/^{86}\text{Sr}$ , 0.717~0.719;  $\epsilon_{\text{Nd}}$ , -9.5~-9.4). In contrast, the Sr and Nd isotopic values of DKP ( $^{87}\text{Sr}/^{86}\text{Sr}$ , 0.705;  $\epsilon_{\text{Nd}}$ , -2.6~0.6) are close to those of the volcanic rocks of Mt. Daisen, which is regarded as the source of the tephra. The isotopic signature suggests that Asian dust also have contributed to the upper part of the upper loam layer. The upward increase of  $^{87}\text{Sr}/^{86}\text{Sr}$  within each of the loam layers suggests that the contribution of Asian dust increased as the proportion of reworked deposits from the underlying layer (dune sand or DKP) decreased by burial. In contrast,  $^{87}\text{Sr}/^{86}\text{Sr}$  in DKP shows little vertical change, suggesting very rapid deposition without entrainment of the underlying lower loam layer.

\*:epsilon

Keywords: Eolian dust, Loess, Coastal dune, Strontium and neodymium isotopes

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## Depositional processes of deep-sea sediments using organic matter analyses, examples from the Kumano Trough

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Deep-sea turbidite is useful tool for long-term paleoseismicity analysis. However turbidity currents occur with not only slope failure by earthquake but also flood and storm. The purpose of this study was to examine depositional processes of turbidite using organic matter analyses.

Study area is in the Kumano Trough, which lies off the Kii Peninsula of central Japan. Sediment cores are from the basin floor (1870 to 1990 m water depth) of western part and submarine canyon (Anoriguchi Canyon, 1660 m water depth) of eastern part of the Kumano Trough. Sediment cores are composed mainly of dark-olive silt layers (hemipelagite) with interbedded turbidites. The turbidite layers are 1 to 15 cm thick. Shirai et al. (2010) revealed that turbidites in western part of the Kumano Trough were deposited by flood due to the 19th century Tostukawa flood (1889) and the Isewan Typhoon (1959). Vertical distributions of <sup>137</sup>Cs in sediment core from the Anoriguchi Canyon implies that the appearance horizon of <sup>137</sup>Cs were located at 12-14 cm below sea floor. The turbidite was deposited before 1954 year, because the turbidite is below the <sup>137</sup>Cs appearance horizon.

Total organic carbon contents and stable organic carbon isotope values were measured using an elemental analyzer and a mass spectrometer of the Atmosphere and Ocean Research Institute, the University of Tokyo. We also observed sedimentary organic matter using reflected light and fluorescence microscopy.

Results of stable carbon isotope analysis showed that terrigenous organic carbon increase above Isewan typhoon and Tostukawa flood induced turbidite in western part of the Kumano Trough. While terrigenous organic carbon does not increase above turbidite in the Anoriguchi Canyon. The turbidite was considered to deposited by failure of canyon head or slope.

Reference: Shirai, M., Omura, A., Wakabayashi, T., Uchida, J. and Ogami, T., 2010, Depositional age and triggering event of turbidites in the western Kumano Trough, central Japan during the last ca. 100 years. *Marine Geology*, 271, 225-235.

Keywords: deep-sea sediment, turbidite, organic matter analyses, Kumano Trough

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## Entradichnus ichnofacies in eolian dune strata (Djadokhta Formation) at Tugrikiin Shiree, southern Mongolia

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Trace fossils provide significant information on the paleoenvironment in which the trace formed. The paleoenvironmental usefulness of the trace fossils is applicable not only to marine strata but also to terrestrial deposits. Eolian sand dune deposits of the Upper Cretaceous Djadokhta Formation at Tugrikiin Shiree, southern Mongolia, yield numerous trace fossils belonging to Entradichnus ichnofacies, which contains Entradichnus meniscus, Skolithos isp, and other ichnospecies. This presentation describes the type ichnospecies, the trace fossil Entradichnus meniscus, a long unlined and unbranched trail that is filled with meniscate laminae and occurs characteristically in positive epirelief. The trail is straight to gently meandering, parallel to the fore-set laminae of the eolian dunes, and their long axes shows predominantly parallel to the depositional dip of the cross-stratification laminae. In addition, almost all the crescentic internal laminae of the trail show concave down-dips. These features indicate the paleoecology of the trace makers, namely the trails were produced beneath the slipface of eolian dunes by the downward burrowing of the trace-makers. Previous studies also reported very similar occurrence mode of the trace fossil from the Jurassic eolian dune deposits in North America. Therefore, the preferred orientation of the trace fossil might be a common feature in arid eolian dune deposits at least during the Jurassic and Cretaceous, and possibly reflecting a behavioral response to the morphology of large sand dunes under an arid climate.

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## Sediment wave developments observed in the Aoshima Formation, Miyazaki Group: based on the interpretation of cyclic step

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Sediment waves, which are a form of depositional topography observed in deep-sea environments, are characterized by orderly reliefs of very long wavelengths with low amplitudes (Migeon et al., 2004). Coarse-grained deposits (sediment-gravity flow deposits with grain sizes  $> 0.25$  mm) and rip-up mud clasts found in sediment wave deposits in deep-sea environments are generally observed on the upslope of the waves; however, they are also deposited on the downslope of the waves through hydraulic jumps (Migeon et al., 2001; Nakajima and Satoh, 2001). Cyclic steps, which have been suggested as one of the causes for the formation of sediment waves, experience such hydraulic jumps (Fildani et al., 2006). Evidence found in outcrops, the fact whether sediment wave deposits are formed in cyclic steps, detailed mapping of grain sizes, and distribution of rip-up mud clasts, essential elements for the determination of hydraulic jumps, are required, in addition to descriptions of sedimentary structures and bed thickness. In this study, we obtained a detailed map of grain sizes and rip-up mud clasts in sediment wave deposits in turbidite successions of the Aoshima Formation, Miyazaki Group, suggested by Takii et al.(2010). We discuss the formation of a sediment wave as the cyclic steps experienced hydraulic jumps during the forming processes.

The Aoshima Formation is the uppermost part of the Miyazaki Group filling the Neogene forearc basins (Shuto, 1952). We studied suggested sediment waves in the outcrops of the Shirahama coast, Miyazaki City. The results revealed that coarse-grained deposits and rip-up mud clasts are distributed at irregular intervals in the sediment-gravity flow deposits, suggesting a migration of the deposits and clasts in the upstream direction. The sediment-gravity flow deposits including coarse-grained deposits and rip-up mud clasts, which are thought to be deposits that experienced hydraulic jumps, are mainly composed of graded beds. The sediment-gravity flow deposits with such graded beds occur alternately with massive beds in the paleocurrent direction. These alternate occurrences in the sediment-gravity flow deposits suggest that cyclic step formation with some intervals of hydraulic jumps.

Keywords: sediment waves, cyclic steps, sediment-gravity flow deposits, hydraulic jumps

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## Characteristic of flood deposits in the Chikugo-gawa River, Kyusyu, West Japan

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We studied a characteristic future of recent flood deposits in the Chikugo-gawa River, Kyusyu, west Japan. This study was based on 8 core samples, taken from main stream of the Chikugo-gawa River. These cores were analyzed of sedimentary structure, grain size distribution, and magnetic susceptibility.

In this presentation, we would like to discuss and consider the characteristic of flood deposits.

Keywords: flood deposits, sedimentary structure, Chikugo-gawa River

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## Fundamental Study on Development of Man-made Beachrock: Mechanical tests and elemental analyses of Beachrocks in Okinawa

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Beachrock is a coastal deposit that is cemented by calcium carbonate and/or silica in the tidal zone of a sandy beach in the tropical zone and the subtropical zone. Considering an application of man-made beachrock to submerged-looking islands as a preservation material, we had performed a literature survey in order to understand essential information of beachrocks. For the study of mechanical properties and mineral contents of beachrock, we performed in situ tests and laboratory tests for beachrocks of Okinawa Island. As a result, it was shown that unconfined compression strength of the beachrocks increased with time and presented about 43.75 MPa after several thousand years. It was also cleared that the strength of the beachrocks was larger than or equal to that of sea water proof concrete using cements of blast-furnace, silica, fly ash and others. Furthermore, it was found that the beachrocks investigated in this paper consisted mainly of Ca and C.

Keywords: beachrock, Okinawa Island, mechanical property, element content

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## Internal Stress Fields of a Large-Scale Submarine Debris Flow

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Detailed analysis of a submarine debris-flow deposit exposed as a nearly 1.6 km continuous outcrop reveals existence of a compressional stress field during transportation and deposition. Deposit of gravelly mudstone, containing large deformed sedimentary blocks (long axis up to 100 m), occurs in the Upper Cretaceous (Maastrichtian) to Paleocene Akkeshi Formation, Hokkaido Island, northern Japan. This mass-transport exposure exhibits three facies, based on size and spatial arrangement of accumulated blocks. Facies A consists of relatively small blocks (long axes approximately 1 to 10 m), supported by a gravelly mudstone matrix. Facies B consists of clast-supported moderate blocks (long axes ~30 m). Generally, blocks in Facies B are deformed significantly. Facies C mainly comprises large blocks with long axes up to 100 m. Facies A and B alternate downcurrent, while Facies C occurs only at the more distal end of the exposure. Usually, long axes of blocks are oriented parallel to the bedding surface, suggesting a laminar state of flow. Application of the multiple inverse method to meso-scale faults observed in the blocks reveals possible internal paleostress fields that existed before deposition. This analysis suggested two different stress fields: (1) a uni-axial compressional stress field, where maximum principal compression axis is normal to bedding surface, and (2) a tri-axial compressional stress field, where orientation of maximum principal compression axis is parallel to paleocurrent direction. Numerical simulation of a submarine debris flow using the bi-linear rheology model indicates that this mass-transport deposit experienced the first stress field when it moved downslope, thereby expanding its surface area. It then experienced the second stress field as it decelerated, because of compression parallel to paleocurrent direction. Although the second stress field caused by deceleration of the flow occurs in any conditions, the first stress field that is related to the initial flow expansion occurs depending on the initial flow geometry and yield strength of the flow matrix. Thus, the result of this study implies that (1) a horizontal compression paleo-stress field can be an indicator of the paleocurrent direction of the debris-flow, which is generally difficult to be reconstructed from the outcrop data. In addition, it is also suggested that existence of a vertical compression paleo-stress field can be a clue for the initial conditions of the submarine landslide.

Keywords: submarine debris flow, paleostress analysis, paleocurrent analysis, gravelly mudstone, submarine landslide