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

HGM22-01 Room:101B Time:May 26 15:15-15:30

Terrain classification of Southwest Japan including the Seto Inland Sea by object based area segmentation

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Terrain classification studies have been predominantly pixel-based using DEMs. Previously the corresponding author developed a pixel-based automated classification method of topography using slope gradient, convexity, and texture calculated from a DEM for small-scaled classification of plains, terraces, hills, mountains, and volcanos (Iwahashi, 1994; Iwahashi and Pike, 2007). However, a pixel-based approach could not handle scale issues or increasing noise associated with enlarging resolution of DEMs. In addition, pixel data include problems of data volume and difficulties in spatial joining with attributes of thematic maps.

Recently object based techniques for land-cover classification using color orthoimages or satellite images have become popular. In this presentation, the authors introduce the method of making terrain-type polygons by object-based software using a combined image of geometric signatures. We produced a terrain classification map of Southwest Japan including the Seto Inland Sea using a 150-m DEM which was a mosaic of land elevation and seafloor elevation. The terrain-type polygons were statistically compared with other thematic maps such as landslide distribution and lithology.

This study was carried out within a framework of ”Mapping of large landslides based on the sea-land combined terrain classification: case study of the overall Outer Zone of Southwest Japan including the Nankai Trough” which was a theme in ’2014 Collaborative Research with the Disaster Prevention Research Institute, Kyoto University’. We would also like to thank the Japan Coast Guard who provided the 150-m and 450-m Geographical Feature Meshes Data of Southwest Japan.

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Keywords: Fundamental Geospatial Data, seafloor topography, object based area segmentation, DEM, terrain classification, Seto Inland Sea

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

HGM22-02 Room:101B Time:May 26 15:30-15:45

Relation between tectonic uplift rates and erosion rates in the Kiso Range from in situ cosmogenic nuclides

NAKAMURA, Atsunori[1*] ; YOKOYAMA, Yusuke[1] ; FUJIWARA, Osamu[2] ; HORI, Kazuaki[3] ; MIYAIRI, Yosuke[1] ; MATSUZAKI, Hiroyuki[4]

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Tectonic uplift enhances the elevation and local relief of mountain ranges (Willett and Brandon, 2002). High relief leads to intensified erosion process through the slope dependent surface processes namely as relief becoming steeper larger erosion process is resulted (Ahnert, 1970). Therefore, documenting rates of uplift and erosion is critical for understating how topography of the mountains is maintained by such a negative feedback. In case of continuous rock uplift, numerical models of landscape evolution suggest that mountain ranges may reach steady states in which uplift rates and erosion rates are balanced, and hence elevation and topography may be maintained (Molnar and England, 1990). In this study, we present erosion rates reconstruction from the drainages of the Tenryu River using terrestrial cosmogenic nuclides (TCN) in order to document their relations to the topographic evolution of the Kiso Range (central Japanese Alps). Measurement of TCN allowed us to determine the erosion rates over the timescale of 10^3 year. We sampled river sediments from the tributaries and the main stream of the Tenryu River. Basin-averaged erosion rates of the tributaries near the main ridgeline of the Kiso Range are 1000-2000 mm/kyr, whereas the southern tributaries have lower erosion rates between 600 and 1000 mm/kyr. In addition to the samples from the modern riverbed, sediment samples were also collected from the drilling cores excavated near the mouth of the Tenryu River in order to reconstruct paleo-erosion rates. Erosion rates using TCN from the core samples show relatively constant erosion rates through the Holocene. Furthermore, previously reported erosion rates using sediment yields (Kawata and Uemoto, 1998) and apatite fission track ages (Sueoka et al., 2012) suggest constant erosion rates of the Kiso Range over 50 yr, 1 kyr, and 1 Myr time scales. These values are comparable with the uplift rate of the Kiso Range (Ikeda et al., 2002), and hence the topography of the range in the central Japan is maintained in a steady state.

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

HGM22-03 Room:101B Time:May 26 15:45-16:00

The limit of the geomorphology learning in high school geographical B

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At most 12 units per 3 years of geography B could be taken in the curriculum which is being put into effect from the previous fiscal year. I even put emphasis on learning of physical geography more than now and am teaching. But the limit has caused the geomorphology with which I deal geographically and the geomorphology with which I deal by earth science in the explanation in a cause different in a viewpoint or the field of the geomorphology and the industrial geography.

It's introduced about the learning contents of geomorphology in a main school by this announcement. And I'd like to receive advice for teachers.

I'm thinking it's to increase the contents of geomorphology that I'm thinking, and understanding in the whole geography deepens. It's esteemed to deal with the reason that fact is explained, not to handle only to appear in a textbook. The following problem has formed by the current state.

1. There is a student going to memorize the distribution of the submarine ridge and the trench. When doing talk of "terrestrial heat flow ", I'm thinking a logic can be grasped.

2. By geography B, crustal alteration, "plate tectonics", only, to explain, the whole tectonics theory can't be fingered. Therefore the limit occurs to the in-depth explanation motive power.

3. The volcanic contents end only by a volcanic stereotype because you can't touch about developmental process of a magma. Mode of eruption and a volcanic ejecta don't also touch, so talk of a produced mineral can't be done. At the same time, a reason and a distribution area of produced resources can't be explained.

4. Only the case that those tomography exists can finger fold and a fault, and a word as lineaments doesn't exist in a textbook. Therefore the significance from which fold and a fault are learned becomes indefinite.

5. The learning which surveys a physical environment in each geologic age is needed. This would like to make them learn to reflect production of resources and the present physical environment.

On the convenience with the restrictions of curriculum guidelines and the case that I organize the contents and teach freely are difficult, but I'd like to ask the education technique which esteemed geomorphology and education contents because it's the entrance where a geography is learned to learn geomorphology.

Keywords: geomorphology, geography, geography B

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

HGM22-04 Room:101B Time:May 26 16:15-16:30

Slope failure of the Oya-Kuzure and generation of the Akamizu Fall, upper reaches of the Abe River, Shizuoka Prefecture

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The “Oya-Kuzure” slope failure is located in the source area of the Abe River, Shizuoka Prefecture. It is estimated that many failure events had occurred repetitively around the area (e.g., Machida, 1959). The latest large-scale failure is estimated as occurring early 18th century. Deposits originated from the 18th century failure filled the Oya River and upstream of the Abe River (e.g., Tsuchiya, 2000).

Although origin of the Akamizu Fall, which is located on main stream of the Abe River with a height of 60 m has been inferred as that stream of the river eroded debris flow deposit filling the valley, that stream of the river flowed across a ridge, and so on, any opinion does not show evidence sufficiently.

As a result of survey, it were confirmed that distribution of debris flow deposits and paleo-current estimated from direction of gravel imbrication in the deposits imply meandering of the Abe River valley before burial by debris flow deposit. In addition, channel of the fall across a ridge of basement rock. We concluded that filling of a valley by debris flow deposit caused shortcut of stream of the Abe River across a ridge and generation of the Akamizu Fall.

Keywords: debris flow deposit, shortcut, Abe River, Akamizu Fall, Oya-Kuzure

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

HGM22-05 Room:101B Time:May 26 16:30-16:45

Landform, debris transport processes and sediment budget in the Dakesawa valley, Northern Alps, central Japan

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The Dakesawa valley is originated in the Mt. Oku-Hotakadake (3190m) and runs down into the River Azusa at the elevation of 1500m. The middle part of the valley is covered with debris which is supplied from the valley side slopes. To discuss the debris transport processes and sediment budget I investigated the characteristics of the valley floor deposits and valley floor landforms. On the middle of the valley bottom, the elevation is between 2180m and 1730m, there are thick unvegetated deposits. The average slope of middle part of the valley floor is 30%. There is no flow water on the valley bottom, because of infiltration to the deposits. From the valley side slope debris are supplied forming talus cones. Erosional scars along the valley floor show debris of the valley floor are originated from the talus cone deposits. Decrease of the size of the valley floor deposits from 3m to 0.5m shows debris transport with sorting process. Debris transported from the upper and middle part stopped entering the forest area. The lower part are filled with huge blocks of talus deposits and debris flow sediments supplied from valley side slopes. Above-mentioned debris closed the outlet of the Dakesawa valley. The upper and middle part deposits cannot reach the lower end of the Dakesawa valley, bordering on the floodplain of the River Azusa. Thus, present day sediments are being accumulated in the valley floor and few sediments flow into the River Azusa.

Keywords: landform, valley floor, debris transport process, sediment budget, Dakesawa, central Japan

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

HGM22-06 Room:101B Time:May 26 16:45-17:00

Natural dam constructions and breaks at the Oshika and the Mitoku River, Misasa-town, Tottori southwest Japan

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Four terrace-like deposits caused by deep seated landslides were known at the lower part of the Oshika River in Misasa, Tottori, south-west Japan. Another similar terrace-like deposit seems to be at the middle part of the Mitoku River in Misasa, which is neighboring north of the Oshika. These five landslides seem to be related to earthquakes caused by the Iwatsubo active fault, which runs in the eastern part next to the Oshika and the Mitoku river basin. The objectives of this study are to clarify whether natural dams were constructed or not, and if there were natural dams, how the dams were broken down.

We conducted topo-map reading to make distribution map of terraces and their longitudinal profiles projected along the river. We did also hand borings to get soil samples in order to measure radioactive carbon datings. In the field, we observed terrace deposits.

At three sites out of the five landslides, natural dams were formed judging from reservoir silty-clay deposit at Sengenbara, Mitoku, or steep gradient (1/8 at Kannokura, 1/13 at Nishioshika, in the Oshika) terraces distributed just downstream-side of the dams in 1.2 to 1.4 km long. Large andesite boulders (ca.1 to 2 m in diameter) were observed as deposits of these dams.12 Carbon 14 dating values showed the followings: i) deep seated landslides occurred at three different times: 34,000 yr ago at Nishioshika and Mogura, 10,300 yr ago at Sengenbara, and 1,200 yr ago at Kannokura. These large landslide events suggest that the Iwatsubo active fault moves at about ca.10,000 yr intervals and successive intensive rainfall caused landslides. ii) Natural dam broke in many batches and the reservoirs maintained for longer times: 400 yr or more at Kannokura, 8,000 yr or more at Sengenbara, and 30,000 yr at Nishioshika. We need datings of Higashioshika landslide event.

Keywords: natural dam, out-burst flooding, deep seated failure, fluvial terraces, radioactive carbon chronology, Iwatsubo active fault

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

HGM22-07 Room:101B Time:May 26 17:00-17:15

Landform development of bedrock river focusing on the planform : Laboratory experiments

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Generally, development of fluvial landform is known to be strongly affected by surface slope, climate and tectonics. In field study, it is necessary to take accounts of developmental stage of individual rivers when discussing relations between various factors and landforms, because we need distinguish between spatial and temporal variations. In this study, we conducted flume experiments focusing mainly on temporal (developmental) change of bedrock river. The flume was about 1 m square and a weir with a slit at the center was installed at the downstream end to prevent change of base level during the run due to uncontrolled sedimentation. Parameters discussed in this study are initial surface slope, precipitation and tilting rate. Findings are as follows. Temporal increase of drainage area occurred through two stages, which is considered to correspond to the formerly reported two-staged development of channel network. Unlike temporal change of drainage area (drainage area vs. time), the relation between drainage area vs. trunk-steam length for each data of different time in an identical basin fell on a single power function. Number in the range of these functions obtained in this study, was n = 0.38 ˜0.83. The drainage basin under smaller precipitation had a power number (power-law exponent) larger than 0.5, meaning that the basin became elongated longitudinally with its development, which is considered to be because tributaries could not grow largely and laterally owing to smaller precipitation. The drainage basin neighboring a larger basin had also a power number larger than 0.5, which can be attributed to suppression of later growth of basin due to small influx of water.

Keywords: laboratory experiment, bedrock river, precipitation rate, drainage area

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

HGM22-P01 Room:Convention Hall Time:May 26 18:15-19:30

Landforms and Vegetation of Limestone Area in the Northernmost Part of the Suzuka Mountains

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Objective of the study is to make clear the relationship between the karst landforms and vegetation in the area of Mt. Ryouzen summit, Shiga prefecture. Geology of the study area mainly consists of limestone. And the karst landforms of the study area are characterized as the karrenfeld and doline. Mountain slopes in the study area are classified and mapped. And the distribution of the dolines was plotted on the map. The shape of dolines in the area was classified into 4 types from the viewpoint of existence of bottom flat and the inner slope condition. Characteristics of the vegetation in the study area are generally related to the condition of mountain slopes. Woody vegetation is distributed in the area of gentle slope, and herbaceous plant mainly distributes in the steep slopes of the region.Distribution of plants on the inner part of the doline wall is related to the direction of the inner wall. Vegetation of the north-facing slopes is characterized by low grasses. In the slopes and bottoms of doline, vegetation is generally sparse or barren condition.

Keywords: karst landform, Mt. Ryouzen, doline, slope, vegetation

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

HGM22-P02 Room:Convention Hall Time:May 26 18:15-19:30

Geomorphological study of the volcanic mud flow in the Fukushima basin

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This paper examined the damage of the volcanic mud flow by the Azuma-yama volcanic eruption. From Azuma-yama, the river are flowing eastward. It seems that a mud flows go down these rivers. For this study, we drew the topographic map based on DEM data. We clarified the range of a mud flow, and the position of the river from this map.

Next, we drew three longitudinal sections of the river which flows into the Fukushima basin from the Azuma-yama volcano. The distance to the Fukushima basin changes greatly with river channels. The arrival time to the Fukushima basin of a mud flow changes with channels. There are three patterns in channels. (1) After going to north, there are channel which changes direction to the east. (2) There is a channel which flows to the east directly. (3) After going to south, there are channel which changes direction to the east. Distance is greatly different by these three patterns. So, the location of a crater is very important because of disaster prevention.

Furthermore, we drew the cross section inside the Fukushima basin.The cross section shows concave form.The cross section has a 60 m depth. A mud flow may concentrate on this hollow. It is necessary to take this geomorphic feature into consideration for anticipation of damage. This study revealed that the channel passage and geomorphic features will influence the damage of volcanic mud flow strongly in Fukushima basin.

Keywords: mud flow, channnels, Azumayama volcano

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

HGM22-P03 Room:Convention Hall Time:May 26 18:15-19:30

The geographical disasters in Shirouma Daisekkei valley , the Northern Japanese Alps.

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Shirouma Daisekkei valley, which is located in the northeast of the Northern Japanese Alps is the largest snow patch of Japan. More than 10,000 climbers pass during every summer. In this valley, rockfall, landslip, debris flow, and snow avalanche cause climbing accidents every year. In this study, we researched rockfall and remobilization of fallen stones in Shirouma-Daisekkei, using field data such as air temperature, surface ground temperature, interval camera, GPS measurement, distribution of rock and geomorphological data of DEM.

Two interval camera shows many rocks on the snow patch appeared by melting snow during July?August. The number of fallen stones on the snow patch was little. Surface ground temperature and air temperature show rockfall caused by freeze-thaw hardly occurs in this period. Although remobilization of fallen stones on the snow patch was known, the distance of remobilization was up to 50 m between end of July and end of August. The small movement of fallen stones was confirmed every day. The slope degree is around 25 degree or less on the main Shirouma-Daiisekkei valley. On the other hand, No. 2 and No. 3 snow patches of tributary valleys are between 26 degree and 40 degree. The steep slope of the No. 2-No. 3 snow patches might be largely related to rockfall accident during this period.

Keywords: Shirouma Daisekkei valley, rockfall, snowpatch, geographical disasters

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

HGM22-P04 Room:Convention Hall Time:May 26 18:15-19:30

Shapes and origins of notches and caves on sea cliffs, the Noto Peninsula, central Japan

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In the Noto Peninsula, there are many notches and caves on sea cliffs. Their major origins may be salt weathering and wave erosion, but few detailed studies have been carried out in the past. A level of wave-cut notch indicates a paleo-sea level, and is useful to estimate uplift rates of the area. Therefore we aimed to classify them into notches and caves formed by wave erosion and those formed by other processes such as salt weathering in this study.

We studied coasts of the Noto Peninsula, and carried out 3D laser scan survey in western coasts where these features are abundant. We obtained red relief image maps which show detailed topographic features of the sea cliffs from DSM (Digital Surface Model) data taken by a laser scan survey to recognize the caves and notches. We also performed geological survey and X-ray diffractometry analysis to determine their origins.

We recognized many caves and notches on sea cliffs composed of Miocene volcanic rocks in western and northern coasts of the Noto Peninsula. In western coasts, Their shapes are classified roughly into two types, linear type and ellipsoid or polygonal type. The former includes vertical, horizontal, and oblique continuous shapes, of which sizes are less than a meter in width. Some of them observed at an altitude of 2 meters in several areas show the scale of a meter in width and horizontal continuous shapes with benches at their base, indicating that they were formed by wave erosion. The caves of the latter are distributed widely over cliffs, and they are dozens of centimeters to several meters in diameter. The occasional existence of white powder, which is composed of gypsum ($CaSO_4 \bullet 2H_2O$) according to X-ray diffractometry analysis, in caves of the latter, indicates that salt weathering is closely related to the formation of this type.

Assuming that wave-cut notches recognized in this study were formed at the same stage, uplift rates of western coasts of the Noto Peninsula are equal after their formation. Therefore it is necessary to determine the age of their formation.

Keywords: the Noto Peninsula, sea cliff, 3D laser scan survey, topography analysis, wave erosion, salt weathering

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

HGM22-P05 Room:Convention Hall Time:May 26 18:15-19:30

Transport processes during MIS 5.1 and MIS 3 to 2 estimated from fluvial terrace gravels in Tama and Sagami rivers

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Fluvial terrace sediments are formed by depositional process of rivers in the past, therefore it may be possible to infer the paleo-river transport processes and the paleo-climate from terrace sediments. To reveal the differences of the river transport processes between MIS 5.1, which is a relative warm period, and MIS 3 to 2, which is a relative cold period, this study examines the change in size and roundness on gravels of fluvial terraces.

Field survey was conducted at Musashino 2 terrace (M2 terrace; MIS 5.1) and the Tachikawa 2 terrace (Tc2 terrace; MIS 3 to 2) in the fan region in the Tama River, and at the Sagamihara 3 terrace (Sg3 terrace; MIS 5.1) and the Tanahara terrace (Th terrace; MIS 3) along the Sagami River around the fan apex in the Sagami River. The mean maximum gravel size and the mean roundness were obtained from the long axes of the 10 largest gravels and 50 gravels, respectively. The distance from the fan apex and the mean slope of the terraces are obtained from 5m mesh DEM published from Geospatial Information Authority of Japan.

Because the Tama and Sagami rivers are estimated to have been under similar scale and paleo-climate conditions, we attempted to explain uniformly the changing trend in the mean roundness of both rivers. As the results, it is estimated that the roundness of MIS 5.1 gravels increases at downstream reaches than that of MIS 3 to 2 gravels.

If the production of fine gravels is active, which is made by crushing, fine gravels should be angular. Conversely, if the production of gravels is inactive, fine gravels which tend to be transported longer distance should be rounded. Relationships between the size and roundness of the measured gravels of mountain region and fan region in the Sagami River suggest that a transport process accompanying with large gravel crushing was active in MIS 5.1. Postulating that gravel crushing occurred by debris flows, it is suggested that the effect of debris flows from tributaries was active during MIS 5.1 than during MIS 3 to 2.

Keywords: fluvial terrace, terrace gravels, Tama River, Sagami River, debris flow

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

HGM22-P06 Room:Convention Hall Time:May 26 18:15-19:30

3D DEM generation from digital aerial photographs considering the influence of vegetation

ENDO, Ryo[1*] ; SUGAI, Toshihiko[1]

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High-resolution topographic data has been generated in Japan according to development of surveying technique. In particular, DEM (Digital Elevation Model) made from LiDAR data is used in various fields. However, topographic data of mountain area is lower in accuracy than that of plain since LiDAR survey is not conducted well in mountain area. Therefore, there are few maps which micro-topography such as scarp or crack is correctly represented on (ex. Yagi et al., 2003; Sato et al., 2004).

Recently, combined technique of Sfm (Structure from motion) and MVS (Multi-View Stereo) has applied to generation of DEM from digital aerial photographs (ex. Uchiyama et al., 2014). Using this technique, we try to generate 3D DEM from GSI digital aerial photographs. One of the most important problems is to remove vegetation from 3D model. In order to minimize the error of removing, we select Kiso Mountain Range as a test field.

The method of this study includes extraction of vegetation area, mask of vegetation area of aerial photographs and, generation of DEM using Sfm-MVS software. NDVI (Normalized Difference Vegetation Index) is an index which is often used to extract vegetation from satellite image. In order to extract vegetation not from satellite image but from digital aerial photographs, an index 2G_RBi (Richardson et al., 2007) is introduced. Correlation between NDVI and 2G_RBi are calculated from Landsat satellite image and threshold between vegetation and the others is decided. After masking vegetation area in aerial photographs, ortho photo and 3D DEM are generated using Agisoft PhotoScan.

In this presentation, we will discuss the DEM and its precision.

Keywords: digital aerial photograph, DEM, ortho image, vegetation, NDVI

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

HGM22-P07 Room:Convention Hall Time:May 26 18:15-19:30

Geomorphic analyses in Bor mining area, Serbia.

WAKASA, Sachi[1*]

[1]Faculty of International Resource Sciences

Geomorphology around Bor mining area, east of Serbia was analyzed. Using Geophysical information was 1:25000 and 1:100000 topological image maps, CAD maps, ASTER-GDEM and high definition satellite images. Channel system and underground-openness (Yokoyama et al., 1999) were analyzed and these maps were combined ASTER-GDEM to make ascent map. On the other hand, land-cover data were estimated from high definition satellite image analyses and spectrum analyses of waste rocks. Obtained data will be reported in this meeting and used to select environmental observation points. Using environmental observation data, geochemical map will be made.

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

HGM22-P08 Room:Convention Hall Time:May 26 18:15-19:30

Evolution of the Gonghe Basin, northeastern Tibet, constrained by in situ cosmogenic radionuclides

SHIRAHAMA, Yoshiki[1*] ; MIYAIRI, Yosuke[2] ; HE, Honglin[3] ; KANO, Ken-ichi[4] ; OKADA, Shinsuke[5] ; YOKOYAMA, Yusuke[2] ; IKEDA, Yasutaka[1]

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Tibetan plateau has been growing up by the collision between Indian and Eurasian Plate and expanding its area laterally by the marginal deformation of the plateau. However, the growth mechanism has been highly debatable. Gonghe Basin at the northeastern margin of the plateau is about 3200 m above the sea level and bordered by Qinghai Nan Shan and Heka Shan on the north and south, respectively. Gonghe Basin was filled with over 500 m thick sediment transported by the Yellow River. Subsequently, the river formed many fluvial terraces while cutting it down. Understanding these processes of sedimentation and later erosion in the basin is an important key for revealing the lateral growth of the plateau. They, however, have not been understood in detail. In order to reveal these processes we applied detailed geomorphological mapping and analyses by in situ cosmogenic radionuclides (CRNs). Our geomorphological mapping by satellite images and digital elevation model show that there are seven steps of fluvial terraces from T1 to T7 and four steps of lacustrine terraces from L1 to L4 in descending order. Our field work revealed that the L1 surface, which is the top lacustrine terrace, is covered with loess of 2-3 m thick including three layers of paleo-soil. This fact indicates that the top lacustrine terrace experienced at least three inter-glatial periods. To decide abandonment ages of lacustrine and fluvial terraces by CRNs concentrations we collected some subsurface samples from L1, T2, and T3. In addition to this, crastic sediments, which fill the basin thickly, were collected at nine points per 50 m depth from the fill top surface to the bottom of the valley for estimating burial history. In this presentation, we will introduce some results of CRNs analyses and their implications in evolution of the basin.

Keywords: Tibetan Plateau, Qaidam Basin, tectonic landform, in situ cosmogenic radionuclide

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

HGM22-P09 Room:Convention Hall Time:May 26 18:15-19:30

Dating the marine terraces in Southern Wakayama and Southwestern Kochi using in-situ cosmogenic nuclides

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Marine terraces are low-relief platforms located along coastal areas. They are formed by waves action with the changes in the relative sea level (RSL) that is affected by combined effects of the eustatic sea level (ESL) and the tectonic movements (e.g. uplift, subsidence and isostatic effect). Therefore, determining the ages and the elevations of the marine terraces allows us to reconstruct the ESL and/or the tectonic history of the study area.

Along the south coast of Japan, particularly at the Kii Peninsula and the southern coast of the Shikoku Island, there exist relatively well-preserved marine terraces. They are now located at the high elevation of ca. 50?100 m, and hence regarded as the suitable counterparts to reconstruct uplift history of the south coast of Japan. However, the ages of these terraces are poorly understood due to the lack of the ash layers that is suitable for the tephrochronology. Here we determine the age of the marine terraces using terrestrial in-situ cosmogenic radionuclides (TCN). This is the first age estimation of the marine terraces in Japan using TCN. Concentrations of TCN in surface rocks have been used for dating the marine terraces in the arid region where negligible erosion is taking place.

The study sites are the Kii Peninsula, Wakayama and the Ashizuri Cape, Kochi, located along the Nankai Trough where the Philippine Sea Plate is subducted under the Eurasian plate. There are several well-preserved marine terraces along the coastal line since the uplift rates of the study area are high owing to the tectonic setting.

Some previous studies tried to estimate the crustal uplift with seismic activity in the Nankai Trough. However, a few studies directly determined the formation age of the marine terraces. We determined the exposure ages and erosion rates in these areas from concentrations of in-situ cosmogenic nuclides.

Keywords: in-situ cosmogenic nuclides, marine terrace, erosion rate

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Pangea was a planet

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[1]MAROSA

1. The Problem

Alfred Wegener had an idea that the unique super continent called Pangea suddenly broke into pieces called continents, which moved along the surface of the Earth.

However, next two major questions were not solved:

(1) Why the super continent Pangea was suddenly broken into pieces?

(2) What kind of force moved the continents?

After Wegener, the theory of plate tectonics prevails, which attributes the force moved the continents to an analogy with thermo fluid dynamics. However, introducing such idea brings about many contradictions.

In this paper, we show you a new theory of planetary impact (Mado 2010), which is able to answer these two questions, is also supported by the real landforms of the current Earth.

2. Continental Drift, Plate Tectonics, Planetary Impact

The theory of continental drift have above two major problems.

The theory of plate tectonics tried to solve the second problem by analogy with thermo liquid dynamics, though it was not able to solve the first problem at all.

It also have a significant mistake in its theoretical basis of aging the oceanic floors. Shinichiro Mado detected two major misunderstandings about oceanic floor aging:

(1) It has a misunderstanding in creating mechanisms of stripes of geo-magnetic anomalies (Mado 2013), and

(2) It has also a misunderstanding in aging the seabed by aging sediments immediately above the seabed, because of neglecting the effects of seawater increase (Mado 2014).

Therefore, plate tectonics should be rejected.

The only one remaining theory is the theory of planetary impact (Mado 2010). The theory solves both of above two problems rationally and persuasively.

3. Landforms created by curvature adaptations

Landforms created by two types of curvature adaptation (Fig.,1 Fig.2, Fig.3) are evidences of the fact of the planetary impact.

3-1. Arabian Peninsula, Indian Peninsula, Indochina

These three peninsulas had been joined in one piece before it was torn into three by the curvature adaptation (Fig.4, Fig.5) after the planetary impact. If the neighboring edges of these three peninsulas were put over the next edge, these three peninsulas would make up a dome like three-dimensional landscape. This is the proof of the fact that a ball shaped object was broken into pieces and torn to make up the current landforms.

3-2. Himalayan fold mountains

The surface of the broken ball shaped object had a greater curvature than the surface of the Earth. Therefore, when the rocks inside the pieces went down into the Earth by the gravity, wrinkles was created on the surfaces of the pieces (Fig.3). This is the reason of the creation of Himalayan fold mountains (Fig.6, Fig.7). Himalayan fold mountains are the evidence of the curvature of the surface of the broken ball shaped object being greater than the current Earth.

4. The Solution

(1) The question, why Pangea was suddenly broken into pieces, will be answered, if we suppose Pangea was a planet which made an impact on the other planet to get into one new planet the Earth.

(2) The question, what kind of force moved continents, is answered, if we suppose the force was the gravity. That is, (a) the

impact was caused by the gravity between both planets collided, and (b) the impact broke into pieces one of these planet, and (c) the force, that moved the pieces along the surface of the other planet rather unbroken, was caused by the impact.

Fortunately, the theory of planetary impact has been demonstrated by the landforms on the surface of the current Earth.

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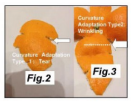
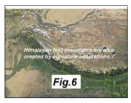
Keywords: continental drift, plate tectonics, planetary impact, Arabian Peninsula, Indian Peninsulas, Indochina, Himalayan fold mountains, Pangea

This peel of a mandarin orange has a greater curvature than the table (Fig.1).
If we push it down on the table, the curvature of the mandarin orange peel will decrease. This is the phenomenon of curvature adaptation.
There are two types: Type 1: torn (Fig.2), and Type 2: wrinkling (Fig.3).
The real landscapes on the Earth are created by the curvature adaptations. For instance, Arabian Peninsula, Indian Peninsula and Indochina are created by the type 1 curvature adaptation.



This peel of a mandarin orange was torn into three just like the real three peninsulas (Fig.5).



The real landscapes of Himalayan fold mountains are created by the type 2 curvature adaptation (Fig.6).

This peel of the mandarin orange of Fig.7 shows you an example of type 2 curvature adaptation, very similar model of Himalayan fold mountains.