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

SSS28-P01 Room:Convention Hall Time:May 27 18:15-19:30

DEM-derived stereo contour maps for visual analysis of tectonic geomorphology

AWATA, Yasuo[1*]

[1]Inst. Eartrhq. Volcano Geology, Geol. Surv. Japan, AIST

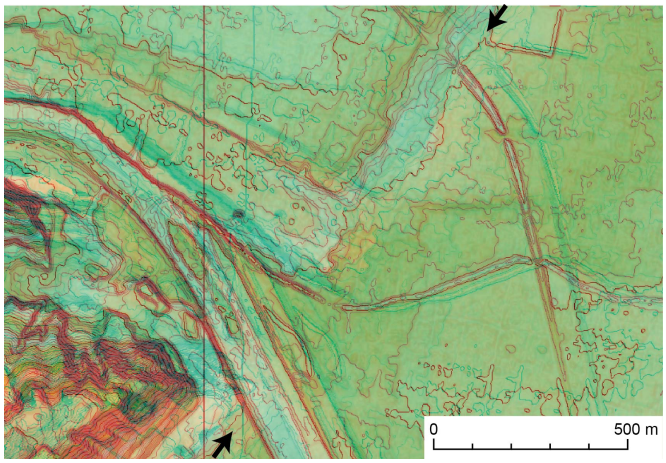
I developed a set of stereo contour maps generated from high quality DEMs to visually analyze geomorphological features in detail. The stereo contour maps together with a stereo slope map are more intuitive and efficient for interpretation of tectonic geomrphology than any existing thematic maps.

A DEM visualization feeware, SimpleDEMViewer is used to generate 2D thematic map and 3D anaglyph map. The 2D contour map is superposed by elevation tints, slope gradation and hillshading to emphasize pseude-3D effect and micro topography. The image size of raster contour map must be adjusted according the mesh size of DEMs, contour interval and slope, and therefore multiple 2D maps are recommended to depict the variety of topography. 3D stereoscopic image in anaglyph makes a substantial visual effect to interpretation of contour maps.

Stereo contour maps are superior to depict geomorphic surface features, such as alluvial plain, fan, terrace surface, and mountain and volcano slopes. Stereo slop map is superior to highlight geomorphic line features, such as lines of ridge, valley and small scarp, and micro topography smaller than a contour interval.

Figure A stereo contour map showing the tectonic geomorphology of the Nagamachi-Rifu fault zone, Sendai, Japan, generated from 5-m-DEM. Arrows indicate the base line of the flexure scarp on terrace surfaces. Contour interval is 1 m.

Keywords: stereo contour map, stereo slope map, DEM, geomorphological analysis, tectonic geomorphology



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

SSS28-P02 Room:Convention Hall Time:May 27 18:15-19:30

Characteristics of the fault zones of their activities terminated until the Early Pleistocene

TSUBAKI, Junichi[1*] ; OHTANI, Tomoyuki[1] ; KONO, Masahiro[1] ; KOJIMA, Satoru[1]

[1]Gifu Univ.

In the active fault surveys without younger sedimentary layers, it is desired that the new method is developed to assess the fault activity using the fault rocks in the basement rocks. To achieve this, it is important to understand the characteristic features of the fault zones not only active faults, but also the faults terminated their activities recently. We studied the fault zone of the Median Tectonic Line (MTL) in Yoshino, Nara, and compare its results with those of the active faults.

The MTL is the active fault in the west of the central part of the Kii peninsula, in which the fault activity is terminated recently in the east. In this eastern area, Okada and Togo (2000) show the fault which terminated its activity until 300 ka in the active fault maps. Sangawa and Okada (1977) reported an exposure of fault zone that makes a border of the Early Pleistocene Lower Shobudani Formation and the Cretaceous Izumi Group, and that is covered by the Middle Pleistocene Upper Shobudani Formation unconformably. Based on the sedimentary ages of their formations (Mizuno and Momohara, 1993), the MTL in this area is terminated until 1 to 1.2 Ma. The fault exposure reported by Sangawa and Okada (1977) is covered by concrete presently, we studied the fault exposures 13 km east and 1 km west away from the previous exposure.

In the former exposure, the fault gouge zone with ca. 1 m thickness strikes E-W. The Izumi formation is in the northern side of the fault zone, in which no exposure in the southern side. The Izumi Formation in this exposure is mainly mudstone. Bedding plane is subholizontal in the host rock, in which foliation is subvertical in cataclasite near the fault gouge. Composite planar fabric in foliated cataclasite indicates the uplift of the southern side. In the latter exposure, the fault gouge zone with ca. 10 cm thickness strikes E-W and distributes between the Izumi formation in the northen side and the Shobudani Formation in the southern side. Matsumoto (2001) reported that the MTL displaces the Upper Shobudani Formation and the activity of the MTL was continue had continued after the deposition of the Upper Shobudani Formation in this exposure.

The powder X-ray diffraction and X-ray fluorescence analyses were performed using the samples from these fault exposures. In the former exposure, the results of the powder X-ray diffraction analysis shows disappearance of mica and formation of chlorite in the foliated cataclasite close to the fault gouge, and decomposition of plagioclase in foliated cataclasite and fault gouge. The altered minerals indicate a remarkable alteration in foliated cataclasite rather than fault gouge. Smectite is not detected in fault gouge and cataclasite. The results of the X-ray fluorescence analysis show the increase of MgO, CaO, Fe2O3 and TiO2 and the decrease of SiO2 toward the cataclasite from the host rocks. From the cataclasite to the fault gouge, MgO, CaO, Fe2O3 and TiO2 decrease and SiO2 increases. The decrease of K2O is especially in foliated cataclasite rather than fault gouge. In the latter exposure, the results of the powder X-ray diffraction show the occurrence of smectite in the fault gouge. The results of the X-ray fluorescence show the increase of MgO, CaO, Fe2O3 and Al2O3 and the decrease of SiO2 toward the fault gouge.

The studied feature is compared by that of the active faults. In the active fault zone, the latest fault gouge is characterized by the formation of smectite and concentration of Mn. Smectite is the mineral formed under lower temperature. Mn deposits under the oxidized condition. These are consistent with recent near-surface condition of the active fault zone. The studied fault zones would be displaced in the deeper part because their activities have been terminated and present surface exposure should be exhumed from 1 to 1.2 Ma to present. Mn is difficult to concentrate in the deeper reduction condition.

Keywords: fault zone

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

SSS28-P03 Room:Convention Hall Time:May 27 18:15-19:30

Fault exposure in the Yokote basin accompanied with the 1896 Rikuu earthquake Akita prefecture, Northeast Japan

ABE, Kohei[1*] ; KUROSAWA, Hideki[2] ; KOSAKA, Hideki[3] ; KAGOHARA, Kyoko[4] ; MIWA, Atsushi[5] ; IMAIZUMI, Toshifumi[6] ; MIYAUCHI, Takahiro[7]

[1]Oyo Corporation, [2]Oyo Corporation, [3]Kankyo Chishitsu Co., Ltd, [4]Yamaguchi University, [5]Oyo Corporation, [6]Tohoku University, [7]Chiba University

Surface ruptures occurred with the 1896 Rikuu earthquake in the northern part of the eastern margin of the Yokote Basin fault zone in Akita Prefecture (the Shiraiwa, Ota, and Senya faults). However, the accurate traces of surface ruptures were not settled especially around the Takayashiki area, Shiraiwa fault.

In this study, we found a new outcrop of the Shiraiwa fault which moved associated with the Rikuu Earthquake and revealed that the surface traces of 1896 faulting was convexly curved to the upstream ward in the valley floor.

Keywords: Rikuu earthquake, surface trace, fault scarp, fault outcrop

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

SSS28-P04 Room:Convention Hall Time:May 27 18:15-19:30

Fault distribution in the Japan Sea

ARAI, Rei[1*] ; KATSUYAMA, Minako[1] ; OIKAWA, Nobutaka[1] ; SHIMIZU, Shoshiro[1] ; ANDO, Goro[1] ; TAKAHASHI, Narumi[1] ; KANEDA, Yoshiyuki[2]

[1]JAMSTEC, [2]Disaster mitigation research center

This study is a part of ”the Comprehensive evaluation of offshore fault information project” by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). The project composes three themes, 1) Collecting seismic survey data and building a database, 2) Data processing and analysis using unified methods, and interpreting faults utilizing the processed seismic sections, 3) Building fault models from the interpreting results and simulating strong motion and tsunami utilizing these models. Here, we present the interpretation of the fault distribution in the Japan Sea and re-processing to trace faults. Various research institutes have conducted seismic surveys over the decades in the Japan Sea. The dense seismic survey data has been collected and provided us an opportunity to observe seismic data from multiple surveys at the same time. This gave us a great advance to investigate and evaluate submarine active faults.

The past seismic survey data was re-processed using state-of-the-art data processing methods for obtaining high resolution seismic profiles. In particular, it is important to remove multiple reflections and we specially paid attention to apply the algorithm for demultiples. The revised seismic profiles defined clearly the geometry of subsurface structure, and provided us better understanding to determine fault system and shape. Since the fault models for simulation require parameters of length, strike and dip angles and depth, a velocity model for entire seismic data must be constructed to convert seismic section in depth unit. With the depth section we carry quality control of the interpretation results and evaluate their spatial distribution. Discussion includes demonstration of the fault interpretation on representative seismic sections from Tsushima-Kita Kyushu area to off northern tip of Hokkaido.

Normal faults which have developed during the opening of the Japan Sea in the Miocene and reverse faults which have developed after from the normal faults under inversion tectonic settings at compressive stress exist along Japan Sea coast. Those faults in the north eastern area especially reverse faults in the earthquake zone of the Nihonkai-Chubu earthquake extend at depth near the Moho. On the other, those reverse faults in landward are in large scale but extend at depth near Upper-Lower crust boundary. Lateral strike-slip faults are developed in the Sanin coast area, and fault-related-fold structures are observed. Those structures were developed under compressive stress field after the opening of the Japan Sea and following lateral stress field was much dominated to form lateral slip. In Kita Kyushu coast area, fault belts, which composes small strike-slip faults, develop forming echelon structure. As studies on 2005 Fukuoka earthquake suggest that those small individual faults could cause interrelated earthquakes, it is very essential to argue the possible occurrence pattern of interrelated earthquakes to build fault model.

Keywords: submarine fault, Japan Sea, seismic survey

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

SSS28-P05 Room:Convention Hall Time:May 27 18:15-19:30

Characteristics of the Eastern Boundary Fault Zone of the Niigata Plain as inferred from gravity anomalies

WADA, Shigeki[1*] ; SAWADA, Akihiro[2] ; HIRAMATSU, Yoshihiro[2] ; OKADA, Shinsuke[3] ; TANAKA, Toshiyuki[4] ; HONDA, Ryo[4]

[1]Graduate School of Natural Science and Technology, Kanazawa University, [2]Institute of Science and Engineering, Kanazawa University, [3]IRIDeS, Tohoku University, [4]Tono Research Institute of Earthquake Science

Along the boundary range of the Niigata plain and the Echigo Mts., the Kushigata Mts. fault zone and the Tsukioka fault zone are distributed in the NNE-SSW direction, and Ikeda *et al.* [2002] call them for the Eastern Boundary Fault Zone of the Niigata Plain (EBFZNP). The EBFZNP is a part of the eastern margin of the northern Fossa Magna, and is distributed along the Shibata-Koide tectonic line proposed by Yamashita [1970]. The Niigata plain is a very thick sedimentary basin of which the thickness is over 6000 m. On the other hand, the basement rocks are exposed at the Echigo Mts. and the Niitsu hill (anticline) has been developed in the west of the Tsukioka fault zone. A high-resolution seismic reflection survey across the Tsukioka fault [Kato *et al.*, 2013] revealed that this fault is a bedding-slip fault which develops along the unconformity between the Miocene base and the basement rocks. Because the geological structure around this region has encountered heavily tectonic deformation, it has been uncertain that how active structures on the surface is related in the subsurface each other.

The purpose of this study is to reveal the characteristics of the EBFZNP through gravity anomalies. We report here the results of a dense gravity survey in and around the EBFZNP and the characteristics of the EBFZNP obtained from gravity analysis.

We conducted a gravity survey from 1st to 9th, September, 2014 in and around the EBFZNP. A Scintrex CG-3M gravimeter was used for the survey. We set the four gravity survey lines across the Tsukioka fault zone and/or the Niitsu hill. The total number of the measurement points was 181 points. The gravity data published by GSI [2006], Yamamoto *et al.* [2011] and Geological Survey of Japan (AIST) [2013] were also compiled in this study.

We applied a terrain correction [Honda and Kono, 2005] and a slab correction [Furuse and Kono, 2003] to the gravity data in addition to a normal correction procedure (the assuming density for Bouguer correction is 2,670 kg/m^3), then obtained a Bouguer anomaly map. The density structural analysis along the four survey lines was carried out by applying the 2-D Talwani method [Talwani *et al.*, 1959]. In order to illustrate discontinuous lines of the geological structures, the filtering processes of the horizontal and vertical first-order differential operation was applied to the Bouguer anomalies.

Bouguer anomalies show low anomalies in the plain side and 40 mGal more high ones than the plain side in the Echigo Mts. side. Both of the steep Bouguer gravity gradients and the zero isolines of vertical differentiation, which represent the tectonic discontinuities in the subsurface, are continuous and clearly extend along the EBFZNP. These features suggest that the subsurface structures of the EBFZNP form a single fault structure. Somewhat high Bouguer anomalies (30 to 40 mGal higher than the plain side) and both of the steep Bouguer gravity gradients and the zero isolines of vertical differentiation exist in the western part of the Niitsu hill.

The dense gravity survey on the seismic line suggests that the EBFZNP is estimated to be a highly west-dipping fault structure because the Bouguer anomalies continuously increase from the west to the east of the line and both the steep Bouguer gravity gradients and the zero isolines are located in the vicinity of the fault traces. This is coincident with the results of the seismic survey. From the density structural analysis, we also reveal that there are the west-dipping blind fault structure and the east-dipping half-graben between the Kushigata Mts. fault zone and the Tsukioka fault zone, and that the Niitsu anticline is an asymmetric structure with gentle western flank.

This study was supported by JSPS KAKENHI Grant Number 26400450.

Keywords: Kushigata Mts. fault zone, Tsukioka fault zone, gravity survey, density structural analysis

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

SSS28-P06 Room:Convention Hall Time:May 27 18:15-19:30

Active tectonics and landform development in Takada and Echigo plain estimated from fluvial terrace data

SHIMIZU, Ryuku[1*] ; HIROUCHI, Daisuke[2]

[1]Graduate Student, Shinshu Univ., [2]Shinshu University

This study area belongs to the Northern Fossa Magna region. In this area, folding deformation due to the fault activity at the time of the earthquake has been reported[Okamura,Y., Ishiyama ,T.,2002]. Long wavelength deformation of the geomorphic surface, such as folds and flexures, the paradoxically is the constraints of underground shape of fault.Therefore, by revealing the details of long-wavelength topography deformation, it is considered to contribute to the understanding of the fault underground shape and evolution. Standing of the above perspective, We have conducted tectonic geomorphological studies on the eastern part of Takada Plain and Echigo Plain, in order to reveal Late Quaternary crustal movement estimated from the formation process of fluvial terraces.

In the poster presentation, We shall report on these results.

Keywords: fluvial terrace, eastern boundary fault zone of the Tkada plain, eastern boundary fault zone of the Tkada plain, crustal movement, tephrochronology

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

SSS28-P07 Room:Convention Hall Time:May 27 18:15-19:30

Offshore active survey ”Kamogawa lowland fault zone” -Result of high-resolution stratigraphic survey-

SAKAMOTO, Izumi[1*] ; YAGI, Masatoshi[1] ; TAKINO, Yoshiyuki[1] ; MATSUSHITA, Kaharu[1] ; ARAKAWA, Takuya[1] ; FUJIMAKI, Mikio[2] ; ABE, Shintarou[3]

[1]School of Marine Science and Technology, Tokai Univ., [2]COR, [3]AIST

Kamogawa lowland fault zone is EW-trending, it is located the south part of Boso peninsula. This fault zone consists of North Kamogawa graben fault and South Kamogawa graben fault. The recurrence period and slip-rate of Kamogawa lowland fault zone has not been clarified until now.

We performed high-resolution stratigraphic survey to confirm a formation, distribution, and displacement of coastal area of the Kamogawa lowland fault zone. Survey area divided into two sub-area 1) Hota area (North-West side extension of the fault zone). 2) Kamogawa area (South-East side extension of the fault zone). We describe results for each sub-area as follow:

<Hota area >

We have carried out the seismic survey with NS direction survey line. Acoustic transparent layer with poor internal reflection was covered in this survey area. And acoustic basement exposed to the seafloor in spots.

<Kamogawa area >

We have carried out the seismic survey with NE-SW or NS direction survey line. Acoustic basement exposed to the seafloor in North part and South part of this area. We recognized the steep escarpment of trending EW and continuing about 3km long. And also tilting structure with NE direction in dip is observed around the coastal side. These two structures distribute to the echelon arrangement.

As described above, we have captured distribute of fault by tectonic relief. But we have not able to gain the proof of recent activity.

Keywords: active fault, Kamogawa lowland fault zone

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

SSS28-P08 Room:Convention Hall Time:May 27 18:15-19:30

Offshore active survey ”Miura peninsula fault groups” - Result of high-resolution stratigraphic survey-

MATSUSHITA, Kaharu[1*] ; SAKAMOTO, Izumi[1] ; YAGI, Masatoshi[1] ; ARAKAWA, Takuya[1] ; FUJIMAKI, Mikio[2] ; ABE, Shintaro[3]

[1]Tokai University, [2]Coastal Ocean Research, [3]AIST

The Miura peninsula fault groups where is lacated in Miura peninsula is subdivided into 5 fault zones in geologically, such as Kinugasa, Kitatake, Takeyama, Minamishimoura and Hikihashi. But section on the offshore area of Miura peninsula fault groups has yet to be fully realized. Therefore, Tokai University preformed high-resolution stratigraphic survey to confirm a formation, distribution, and displacement of crust around the coastal area of the Miura peninsula fault groups at Sagami Bay and Tokyo Bay (Kaneda Bay) in 2014.

Sagami Bays result has not seen surficial deposit, because of there exposed basement rock. The basement rocks were confirmed that are extension of the peninsula fault groups. But we can not get geological information of theres active histories.

In Kaneda Bay, it was confirmed that shows the structure of strike slip. There were confirmed that are about 1.5 km width to NE-SW direction where there are 3 km offshore of Kaneda Bay. There was no reflector in the surface sediment above the Kaneda bay fault. So, we could not estimate the active histories of these fault.

Keywords: Miura peninsula fault groups, Sagami Bay, Kaneda Bay

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

SSS28-P09 Room:Convention Hall Time:May 27 18:15-19:30

Recurrence History and Crustal Movement for Recent Four Times of Kanto Earthquakes at Southern Miura Peninsula

KIM, Haeng yoong[1*] ; MANNEN, Kazutaka[1] ; KUMAKI, Yohta[2] ; MATSUSHIMA, Yoshiaki[3]

[1]Hot Springs Research Institute of Kanagawa Prefecture, [2]Senshu University, [3]Kanagawa Prefecture Museum of Natural History

The purpose is geologically to resolve the occurrence timing and the accumulation process of the crustal movement associated with the Kanto Earthquake repeated at the plate boundary along the Sagami Trough. Study site is the coastal lower land along Bishamon Bay which an estuary is formed in south Miura Peninsula. An evidence of four times of Kanto earthquake during approximately 1000 years was identified, and the crustal movement cycle caused by these earthquakes was estimated. (Figure 1).

In the low land, the Holocene flights of marine terrace with the low cliff of 1-2m in height were authorized (National Geography Survey, 1981) . In this study, moreover, the lowest terrace was classified in five terraces from the interpretation of the aerial photographs. We named these lower terraces L1, L2, L3, L4 and L5 in the old order.

The low land is raised for development now. From boring survey, the sediment mixed for abundant shell fragments and gravels in motley was founded below +2m above sea level. These deposits are estimated the tidal-flat deposits from such facies, those are uplifted clearly. The elevation of these tidal-flat deposits varies according to terraces; L2:0.6 - 2.0 m, L3:1.2 m, L4: 1.6 m, L5: 0.9 - 1.6 m. Moreover, the timing that these tidal-flat deposits were uplifted varies according to terraces from the radio carbon analysis of woods and shells and from the Cs137 and Pb210 analysis of the sediments; L2: between 1000 and 1210 cal. AD, L3: after 1260 cal.AD, L4: 1703AD, L5: 1923AD. These show that the terraces is a marine terraces formed with an uplifting of the tidal flat deposits.

It is inferred that the marine terraces are formed by a sudden upheaval caused by the Kanto earthquake, and it is recognized that the terrace formation of the L3, L4 and L5 are associated with 1293 Earthquake, 1703 Earthquake and 1923 Earthquake in historical documents. In addition, the generation of L2 is before 1210 cal. AD, but the earthquake during 1180 AD through 1210 AD is unknown in the AZUMAKAGAMI which is a history editing book of the Kamakura Shogunate Therefore, the earthquake corresponding to L2 is estimated after 1000 from the radiocarbon dating before 1180 from the AZUMAKAGAMI.

The recurrence interval of the Kanto earthquake varies; 113 to 293 years for before 1293 Earthquake during 1180 AD through 1210 AD, 410 years for between 1293 Earthquake and 1703 Eathquake, and 220 years for between 1703 Earthquake and 1923 Earthquake.

The elevation of lower terraces L2, L3, L4 and L5 is almost similar. Miura Peninsula greatly is uplifted during the earthquake occurred at the plate boundary along the Sagami Trough, but slowly is subsided between earthquakes. Through historical age, the uplift in associated with earthquake is returned in the period between a former earthquake and a next earthquake.

Keywords: Kanto Earthquake, Recurrence Interval, Residual Displacement, Paleo Seismology

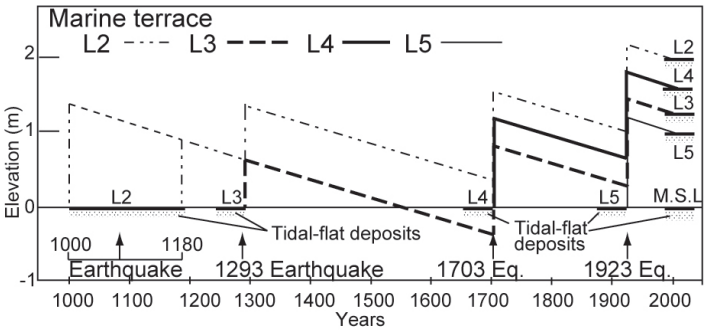


Figure1 Estimation of the Accumulation Process of Vertical Displacement associated with Recently Four times of Kanto Earthquake

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

SSS28-P10 Room:Convention Hall Time:May 27 18:15-19:30

Structural features of co-seismic surface ruptures produced by the 2014 Mw 6.2 Nagano earthquake, central Japan

LIN, Aiming[1*] ; SANO, Mikako[1] ; YAN, Bing[1] ; WANG, Maomao[1]

[1]Department of Geophysics, Graduate School of Science, Kyoto Univ., Japan

The 2014 Mw 6.2 (Mj 6.8) Nagano earthquake occurred at 22:08 (Japan Standard Time) on 22 November, 2014 and resulted in extensive damage in the intermontane area of northern Nagano Prefecture, central Japan (Japan Meteorological Agency, 2014). A maximum seismic intensity of 6.0 (on the Japanese seven-point seismic intensity scale) was observed in the area around the epicenter of the earthquake. Our survey group traveled to the epicentral area one day after the earthquake to investigate the mechanism, earthquake surface deformation features, and nature of the seismogenic fault. We undertook one week of fieldwork, during which time we collected primary field data related to the geometry, morphology, and spatial distribution of co-seismic surface displacements. Here, we report the main results of our field investigations. We also discuss the co-seismic rupturing mechanism and the implications of our findings for the seismo-tectonics of the Itoigawa-Shizuoka Tectonic Line (ISTL).

Field investigations reveal that the Mj 6.8 (Mw 6.2) Nagano (Japan) earthquake of 22 November 2014 produced a 9.3-km-long co-seismic surface rupture zone. Slip occurred on the pre-existing active Kamishiro Fault, which is developed along the Itoigawa-Shizuoka Tectonic Line, which defines the boundary between the Eurasian and North American plates. The surface-rupturing earthquake produced dominant thrusting and subordinate strike-slip displacement. Structures that developed during the co-seismic surface rupture include thrust faults, fault scarps, en-echelon tension cracks, folding structures such as mole tracks and flexural folds, and sand-boils. The surface displacements measured in the field range from ˜5 cm to 1.5 m in the vertical (typically 0.5-1 m), accompanied by a strike-slip component that reached 0.7 m along NE-trending ruptures. These observations indicate a thrust-dominated displacement along the seismogenic fault. Our results show that (i) the pre-existing Kamishiro Fault, which strikes NNE-SSW, controlled the spatial distribution of co-seismic surface ruptures and displacements; and (ii) the style and magnitude of thrust displacements indicate that the present-day shortening strain on the Eurasian?North American plate boundary in the study area is released mainly by seismic thrust displacements along the active Kamishiro Fault.

Keywords: 2014 Mw 6.2 Nagano earthquake, co-seismic surface rupture, Kamishiro Fault, Itoigawa?Shizuoka Tectonic Line, plate boundary, thrust

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

SSS28-P11 Room:Convention Hall Time:May 27 18:15-19:30

Surface rupture of the 2014 Kamishiro fault earthquake

HIROUCHI, Daisuke[1*] ; SUGITO, Nobuhiko[2] ; KANEDA, Heitaro[3] ; GOTO, Hideaki[4] ; MATSUTA, Nobuhisa[5] ; SUZUKI, Yasuhiro[6] ; ISHIGURO, Satoshi[7] ; KUMAHARA, Yasuhiro[4] ; GEOMORPHOLOGICAL RESEARCH, Group[1]

[1]Shinshu Univ., [2]Housei Univ., [3]Chiba Univ., [4]Hiroshima Univ., [5]Okayama Univ., [6]Nagoya Univ., [7]National Institute for Envronmental Studies

The Kamishiro fault is located in the northernmost part of the 150-km-long Itoigawa-Shizuoka Tectonic Line (ISTL) active fault zone, central Japan. Immediately after the destructive Mj 6.7 earthquake of November 22, 2014, which occurred in the northern part of the Nagano Prefecture, we conducted field reconnaissance surveys, and found coseismic surface ruptures exactly along the northern part of the reverse-faulting Kamishiro fault. Based on our surveys, in addition to the reports of other universities or research institutes, primary coseismic surface ruptures extend for ca. 9 km, most of which runs along the previously-identified active fault traces (Research Group for ISTL Tectonic Landforms, 2007; Suzuki et al., 2009, 2010). Various methodologies to record the surface ruptures have been applied until now, including aerial photographs, UAV and high-pole SfM, TLS (Terrestrial Laser Scanner), AL (Auto Level), and TS (Total Station), as reported in other presentations.

Keywords: The 2014 Kamishiro fault earthquake, surface rupture, ISTL active fault zone

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

SSS28-P12 Room:Convention Hall Time:May 27 18:15-19:30

Active fault along the Kamishiro fault, Central Japan, Especially its close coincidence with the location of the surface

SAWA, Hiroshi[1*] ; MATSUTA, Nobuhisa[2] ; WATANABE, Mitsuhisa[3] ; SUZUKI, Yasuhiro[4] ; NAKATA, Takashi[5] ; GEOMORPHOLOGICAL RESEARCH GROUP FOR, The 2014 kamishiro fault earthquake[4]

[1]National Institute of Technology, Tsuruoka College, [2]Okayama University, [3]Toyo University, [4]Nagoya University, [5]Hiroshima University

Introduction

On November 22, 2014 at 10:08 PM local time, a JMA magnitude-6.7 earthquake (the 2014 Kamishiro fault earthquake) occurred in northern Nagano Prefecture, central Japan. The spatial distribution of aftershocks and the focal mechanism indicates that this earthquake was generated by movement along a reverse fault known as the Kamishiro fault - the northern part of the Itoigawa - Shizuoka Tectonic Line (ISTL) active fault system. Remarkable surface ruptures, over 9 km long, appeared along the Kamishiro fault. We have made public details about the nature and location of the Kamishiro fault before the earthquake on an active fault map (Matsuta et al, 2006; Research Group for ISTL Tectonic Landforms, 2007; http://danso.env.nagoya-u.ac.jp/istl-gis/). We wish to establish a location relationship between this surface rupture and the pre-existing active fault trace.

Re-examination of active fault maps of ISTL

Most of the 2014 surface ruptures appeared along pre-existing active fault traces. However, a very few surface ruptures appeared where there was no pre-existing active fault trace, prompting us to re-examine our former active fault maps. We looked again at a series of 1:10,000 aerial photographs archived in the 1940s and 1950s. The aerial photo analysis was supplemented and reinforced by field observations. Although the detailed re-interpretation of aerial photographs caused a few modifications of the locations of active fault traces, we concluded that the location of some active fault traces had not been added on former maps.

Implications for long-term earthquake prediction

The surface ruptures associated with the 2014 Kamishiro fault earthquake appeared in the area covered by a detailed active fault map (Matsuta et al, 2006; Research Group for ISTL Tectonic Landforms, 2007). Most of the 2014 surface ruptures appeared along pre-existing active fault traces shown on the maps. The proper maintenance of an active fault map contributes greatly to earthquake damage reduction. In this area, there have been three active fault maps apart from our map (Ikeda et al., 2002; Sawa et al., 1999; Togo et al., 1999). However, almost no back-thrust faulting associated with the main Kamishiro fault has been mapped on these three maps. The 2014 surface ruptures appeared along some back-thrust traces. It is important that we study small - less than 1 m - tectonic landforms, i.e., reverse tilting of the surface, flexural scarp, scarplet and back-thrust scarp. In the northern part of the ISTL active fault system (Hakuba Village to Matsumoto City, with a length of 55 km), the maximum vertical offset and a JMA magnitude during the last earthquake were estimated to be 5 - 6 m and MJMA 8.2 - 8.3, respectively (Suzuki et al., 2010). However, the maximum vertical offset during the 2014 Kamishiro fault earthquake is approximately one fifth as large as the above estimation. It could indicate that one-scale-smaller earthquake with MJMA -7 has been probably occurring with a shorter interval in the northern part of ISTL active fault system. Considering such a supposition, we need to re-evaluate a long-term earthquake prediction properly.

Keywords: the 2014 Kamishiro fault earthquake, Surface rupture, Active fault, Tectonic landform, Detailed active fault map

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

SSS28-P13 Room:Convention Hall Time:May 27 18:15-19:30

About the amount of fault displacement presumed from oblique aerial photograph.

KOBAYASHI, Hiroshi[1*] ; SUZUKI, Hideo[1] ; KIMURA, Ryouzou[1]

[1]Aero Asahi Corporation

When an inland inland earthquake occurred, I clarify the relations with the authorization of the seismic dislocation and the known active fault, and it is important to get a clue to estimate earthquake mechanism in detail. I can grasp the section of the active fault of a prediction of the future aftershock activity and non-activity if I can grasp mechanism in detail.It is necessary to investigate distribution of the surface of the earth displacement around the focal region regionally to estimate earthquake mechanism in detail, but it is difficult to raise investigation efficiency in the Yamaji region because it is a survey-based investigation. By the method using the aerial photo reading of the one wide area, cyclopedic for existence of ground surface displacement; can make it out effectively, but it is difficult to estimate the quantity of displacement particularly perpendicular displacement quantity.In an earthquake to assume Kamishiro dislocation of North Nagano that occurred this time on November 22, 2014 cause, I confirmed secondary dislocation parallel east of the Kamishiro dislocation from the slant aerial photo group photographed in a news purpose and succeeded in making the simple three dimensions topography model. As a result, I was able to estimate perpendicular displacement in the dislocation concerned at approximately 0.3m.This area was snow area in the winter season, and a quick investigation was necessary for the surface of the earth survey when I did the snow not to be able to do it. This dislocation was investigated just before the snow afterwards By the surface of the earth survey of a different researcher, but there is value in the simple three dimensions topography model enough if I cannot investigate it.It will be important in future to examine a method of precision confirmation of this technique and the establishment of an effective photography method and the cyclopedic photography of the wide area.

Keywords: fault associated with earthquake, ground surface displacement, Investigation for wide-area, oblique aerial photograph, three-dimensional terrain model

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

SSS28-P14 Room:Convention Hall Time:May 27 18:15-19:30

Reconstruction of paleo-slips based on DEMs and geologic sections across the East Matsumoto Basin faults of ISTL

KONDO, Hisao[1*] ; TANIGUCHI, Kaoru[4] ; KATSUBE, Aya[1] ; KIMURA, Haruo[2] ; MORI, Hiroshi[1] ; KUROSAWA, Hideki[3] ; KOSHIKA, Kota[3]

[1]Geological Survey of Japan, AIST, [2]Central Research Institute of Electric Power Industry, [3]OYO COOPERATION, [4]Geological Survey of Japan, AIST (Now at Crearia Inc.)

The ISTL active fault system extending for about 150-160km long is one of the most active fault systems in Japan. The earthquake probability of the Gofukuji fault, composed of the central section of the fault system, is well known to be 14 % in the next 30 years. This estimation is based on paleoseismological researches and long term forecast on the fault, and the maximum size of the next earthquake is expected to be M8 class. However, the size of the next earthquake on the Gofukuji fault is still under the discussion, especially, whether the rupture would propagate with the adjacent faults to the north and south. Since the East Matsumoto Basin fault is located to the north of the Gofukuji fault, the recurrence behavior and slip per event are significant to estimate the past multi-segment earthquakes on the fault system. To address these issues, we conducted detailed mapping of the faults based on the 2-m-DEMs interpretation, trench, borehole and shallow seismic reflection surveys. As a result, we reconstructed possible three slips per event during the last 9000 years at the Aizome site on the northern section of the East Matsumoto Basin faults. The reconstructed vertical slip is 1.8 m as the average value for the last three events. The 1.8-m-slip is converted to be 3.6-4.3 m as dip slip component, because the dip of the fault across the geologic section is measured at 25-30 degreee to the east. Judging from the amount of slip per event, the size of the earthquake is empirically estimated at M7.6. Meanwhile, based on the relationship between length of the East Matsumoto Basin faults and the size of the earthquake, the magnitude of earthquake is estimated at M7.0. This discrepancy of the estimated magnitude means that the most recent three earthquakes did not rupture only the East Matsumoto Basin faults as single segment earthquakes but ruptured in tandem with adjacent faults. Thus, the reconstruction of slip per event during individual paleoseismic events is essential to reveal the spatial extent of past earthquakes, hence, paleoearthquake scenario can be reconstructed based on densely populated actual slip per event data.

Keywords: active fault, paleoseismology, ISTL active fault system, East Matsumoto Basin faults, coseismic slip

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

SSS28-P15 Room:Convention Hall Time:May 27 18:15-19:30

Drilling Survey and GPR Profiling on the Chino Fault in the Middle ISTL Active Fault System, Central Japan

TANIGUCHI, Kaoru[1*] ; KONDO, Hisao[1] ; KIMURA, Haruo[2] ; SUGITO, Nobuhiko[3] ; ICHIKAWA, Kiyoshi[4]

[1]IEVG, AIST, [2]CRIEPI, [3]Hosei University, [4]Komazawa University

The 150-km-long Itoigawa-Shizuoka Tectonic Line active fault system (ISTL) in central Japan is one of the most active fault systems in Japan. The Chino fault is located in the middle part of the ISTL. The fault is characterized by a left-lateral high-average slip rate reaching 10 mm/yr, which is one of the most highest slip rates reported on active faults onshore in Japan. Along the linear fault traces of the Chino fault, terrace risers and river channels are systematically deflected by left-lateral slip, and fault scarps caused by vertical component of slip are identified in late Quaternary terrace surfaces. We carried out drilling surveys and ground penetrating radar profiling at Sakamuro, Chino City, for estimating activity of the Chino fault. Details of our results will be reported in the presentation.

Keywords: active fault, drilling survey, ground penetrating radar profiling, ISTL

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

SSS28-P16 Room:Convention Hall Time:May 27 18:15-19:30

S-wave seismic refletion profiling across the Horikawa fault, Nagoya central Japan

NAKAMURA, Yuki[1] ; IMAIZUMI, Mitsutaka[1] ; TODA, Saya[1] ; NAGAYA, Junko[1] ; NOMURA, Takaya[1] ; TODA, Shigeru[1*]

[1]Aichi University of Education

A seismic reflection survey was made in Nagoya city, the Nobi Plain Chubu region. According to Sugito and Goto (2012), the Horikawa fault is an N-S striking, 10 km long, reverse fault located on the central Nagoya.

The survey line was carried out across the Horikawa fault. A S-wave handy vibrator seismic source (Geomatrix Earth Science Ltd, Elvis) and, a 24 channel seismic recording system (Seismic Source, DAQlink 3) was used for these surveys. The spread of the source and receivers was usually the split-spread type with the shot and receiver intervals being 1 meter. Maximum receiver-group offset was 48 meter. Single geophones of 30 Hz natural frequency were used. The sampling rate for all data was 1.0 msec. Sweep length and frequency selected 10 sec. and 20 - 80 Hz, respectively.

Field data were analyzed by using a general CMP Stack Method. Static correction was made by using the first arrival times based on the seismic refraction method, and predictive deconvolution was applied. Velocity analysis was carried out by constant velocity stack and velocity-spectrum method. The RMS velocity was picked up, and the interval velocities were calculated from the resultant RMS velocities. F-K migration was applied to the time sections.

The results of this study are summarized as follows:

The subsurface structure of the Horikawa fault was discerned in a buried fault zone and they form reverse fault.

Growing seismic strata was recognized in Holocene sediments.

Keywords: Horikawa fault, S-wave seismic reflecton profiling, Nagoya city, Active fault

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

SSS28-P17 Room:Convention Hall Time:May 27 18:15-19:30

Paleoseismological survey on the Median Tectonic Line active fault zone in Kinki district

TSUTSUMI, Hiroyuki[1*] ; SUGITO, Nobuhiko[2] ; OKADA, Atsumasa[3] ; GOTO, Hideaki[4] ; KORIYA, Yorihide[5] ; TANIGUCHI, Kaoru[5] ; OMATA, Masashi[5]

[1]Kyoto Univ., [2]Hosei Univ., [3]Ritsumeikan Univ., [4]Hiroshima Univ., [5]Crearia Co. Ltd.

Under the comprehensive study program on the Median Tectonic Line active fault zone in Kinki district supported by MEXT, we have conducted paleoseismic trenching and arrayed borehole drilling of the fault zone in the past two years. We present the preliminary observations and interpretations on the late Quaternary faulting history of the different segments of the fault zone.

Keywords: Median Tectonic Line active fault zone, Kinki district, Paleoseismology, Trenching, Arrayed borehole survey

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

SSS28-P18 Room:Convention Hall Time:May 27 18:15-19:30

Distribution and tectonic landforms around the Tsutsuga fault zone, western Chugoku region, Japan

TAJIKARA, Masayoshi[1*] ; NAKATA, Takashi[2] ; TSUTSUMI, Hiroyuki[3] ; GOTO, Hideaki[2] ; MIZUMOTO, Tadaki[1] ; MATSUDA, Tokihiko[1]

[1]ERC, ADEP, [2]Hiroshima Univ., [3]Kyoto Univ.

In the western Chugoku district (Yamaguchi prefecture, western Hiroshima Prefecture, western Shimane Prefecture), it has been thought that distribution of active faults is very sparse. However, several active faults were newly mapped by several researchers in recent years. We have been mapped active faults in the whole area of the Chugoku District by detailed air photograph interpretation during the last several years. As a result, we revealed that many active faults are densely distributed in this area. In this presentation, we report tectonic geomorphology along the Tsutsuga Fault Zone and its adjacent areas as an example of such active faults, and discuss the characteristics of distribution pattern of this Fault Zone.

Although distribution of active fault traces in our result is similar to those of the published data in large scale view, some active fault traces are mapped in different location and some active faults traces are newly mapped. Along the previously mapped active faults traces, many tectonic landforms (lateral offset streams, offset hills, beheaded stream, dammed stream) are newly mapped. As a result, we clarified that the Tsutsuga fault zone is an active fault system with 100 km in length. However, based on distribution of fault traces, we consider that a segment boundary exists at the central part of the Tsutsuga fault zone, and that the length of the northern part and the southern part of the fault zone are 60 km and 44 km, respectively. Therefore, the northern and southern part of the fault zone have a capability of causing M7.8 and M7.6 earthquake, respectively.

Keywords: Tsutsuga fault, active fault, Chugoku, inland earthquake, air photo

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

SSS28-P19 Room:Convention Hall Time:May 27 18:15-19:30

Damage and seismic intensity distributions of the 1946 Nankai earthquake by the reanalysis of questionnaire survey

HARADA, Tomoya[1*] ; MUROTANI, Satoko[1] ; SATAKE, Kenji[1] ; FURUMURA, Takashi[1]

[1]Earthquake Research Institute, Univ. of Tokyo

A questionnaire survey to investigate the strength of felt ground motion and earthquake induced damage of the 1946 Nankai earthquake was performed immediately after the earthquake for elementary schools in western Japan by the Earthquake Research Institute and the Department of Science of Tokyo Imperial University, but the results has not been published. We analyzed the questionnaire and summary sheets of the survey, and estimated the distributions of seismic intensity, various kinds of damage, and human behaviors. Total number of responses is 1,034 and we obtained 1, 014 seismic intensities on modified Mercalli (MM) scale.

The questionnaire consists of 28 questions and descriptions for seismic intensities on the MM intensity scale. The maximum seismic intensity estimated from the damage of Japanese-style wooden houses reaches X-XI near the source-rupture area such as in Shikoku Island and Wakayama and Okayama Prefectures. The damage rate of wooden houses was more serious in the populated cities in the plains and basins than that in the mountainous regions. The expected seismic intensities from other damage (bridges, stone walls, underground pipes, etc.) also exceed X. The X or higher seismic intensities on MM-scale corresponds to VII on the Japan Meteorological Agency's intensity scale (JMA-scale), which was introduced only after the 1948 Fukui earthquake (M7.1). Therefore, the previously-estimated seismic intensity distribution of the 1946 earthquake on the JMA-scale may be underestimated. The questionnaire survey also shows that sand boils by liquefactions were generated in Mie Prefecture even though it is located relatively far from the 1946 source region.

Acknowledgement: This study was supported by the MEXT's "New disaster mitigation research project on Mega thrust earthquakes around Nankai/Ryukyu subduction zones".

Keywords: 1946 Nankai earthquake, questionnaire survey, Modified Mercalli (MM) seismic intensity scale, seismic intensity distribution, earthquake damage distribution

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

SSS28-P20 Room:Convention Hall Time:May 27 18:15-19:30

Submarine rock forming structures at shore of Kochi Prefecture and their correlation with historical Nankai earthquakes

TANIKAWA, Wataru[1*] ; YAMAMOTO, Yuhji[2] ; MURAYAMA, Masafumi[2] ; TOKUYAMA, Eiichi[2] ; WAKAKI, Shigeyuki[1] ; HIROSE, Takehiro[1] ; IJIRI, Akira[1] ; HOSHINO, Tatsuhiko[1]

[1]JAMSTEC/KCC, [2]Center for Advanced Marine Core Research, Kochi University

Ancient documents and folklores about Kochi area tell the story about 'Kuroda-gori' which is the small village that was thought to be submerged by the historical Nankai earthquakes. An interesting fact is that ancient artificial buildings and artifacts had been found in seafloor at the shores of Kochi Prefecture. Historical tsunami disasters might have formed these artificial artifacts, though, the relationship between the ancient foundation and the historical Nankai earthquake is not well understood.

A rock forming structure which looks like ocean bank was formed under sea along the coast near the Kashiwa-jima, a western end of Kochi Prefecture. This ocean bank with 2 m height is made by stacking conglomerates, and spaces between conglomerates were filled by solid fine grained matrix, which bond to conglomerates strongly. This 'ocean bank' is elongated along the coast and parallel to the historical onshore bank made in the Edo period. These features indicates the structure could be an artifact. However, conglomerates were randomly piled up, and the similar structures, called as beach rock, can be formed in natural sediment process. 'Artificial' concrete was began to use as building materials in the Meiji period. Therefore, three assumptions listed below are possible to explain the bank like structures in Kashiwa-jima.

1. Real ocean bank made by artificial cement material, which was used as bank and local harbor
2. Beach rock (natural structure)
3. A man-made stone wall, only matrix cement was formed by natural phenomena

Revealing the origin of the seafloor structures are interesting itself, though to evaluate the coseismic uplift and subsidence process and the scale of earthquake-induced disasters, it is important to investigate the age and the environment in which the structure was built.

In this study, we carried out radiocarbon dating, Sr isotope analysis, and chemical analyses (XRF, SIMS) to determine the age and environment when and where the structure was built. These data are compared to those from the river banks near Kochi city and the onshore banks near the ocean bank.

Acknowledgement
We appreciate the technical support by Nippon Kaiyo ltd.

Keywords: Nankai earthquake, beach rock, cementation, coseismic uplift and subsidence

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

SSS28-P21 Room:Convention Hall Time:May 27 18:15-19:30

High-resolution Multi-Channel Sonic survey on the seaward extension of the Kokura-Higashi Faults

KAGOHARA, Kyoko[1*] ; YOSHIOKA, Toshikazu[2] ; KATO, Isamu[3] ; HAMBA, Yasuhiro[3]

[1]Yamaguchi Univ., [2]IEVG, AIST, [3]Kawasaki Geological Engineering Co. Ltd.

The Kokura-Higashi Faults are NNE-SSW trending left lateral strike-slip fault. It is recognized obviously the Kokura-Higashi Faults are distributing from Kokura-Kita to Kokura-Minami ward, Fukuoka Prefecture. However, the Headquarters for Earthquake Research Promotion (2013) pointed that the northern extent of the faults could reach to off Hikoshima, Hibiki-nada, based on the distribution of steep gravity gradient zone in the northern Kyushu. We have conducted a high-resolution multi-channel sonic survey using Boomer source and 12-channel, 2.5-m-channel-interval streamer to clarify the precise fault distribution and structure in Hibiki-nada. The acoustic profiles imaged several faults that deform shallow strata.

Keywords: Kokura-Higashi Faults, multi-channel sonic survey, strike-slip fault, Hibiki-nada

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

SSS28-P22 Room:Convention Hall Time:May 27 18:15-19:30

Paleoseimological study of the Kokura-higashi fault and the Fukuchiyama fault zone in northern Kyushu Island, Japan

YOSHIOKA, Toshikazu[1*] ; TANIGUCHI, Kaoru[1] ; HOSOYA, Takashi[2] ; UEKI, Tadamasa[2] ; MORITA, Sachiko[2]

[1]Institute of Earthquake and Volcano Geology, AIST, [2]Chuo Kaihatsu Corporation

The Kokura-higashi fault is an active fault extending in NNE-SSW direction with west-side-up vertical displacement. The Fukuchiyama fault is extending in NNW-SSE direction with also west-side-up vertical displacement. Both are located in the northern Kyushu Island. The Earthquake Research Committee evaluated that the probability of the earthquake occurrence in the future on the Kokura-higashi fault and the Fukuchiyama fault zone are unknown or ambiguous because of the luck of paleoseismological data. We carried out a trench excavation study and boring surveys on both faults.

A trench is excavated on the fault trace of the Kokura-higashi fault, and three trenches are excavated on the Fukuchiyama fault. On the trench wall of the Kokura-higashi fault, a steeply dipping fault cutting bedrocks and overlying sediments was cropped out. The lower part of the sediments includes some humic soil layers with many wood fragments. The fault displaces these layers vertically in more than 1 meter, and cuts until the top of the sediments just below artificial soil. Two faulting events and former two liquefied events are revealed on the trench wall. The penultimate faulting event is recognized because younger sediments cover a subordinary fault cut lower humic soil layers at the downthrown side of the main fault. This event may have occurred in 19-20 ka.

As the result of the trenching survey on the Fukuchiyama fault, the boundary fault between the Paleogene sedimentary rocks and the Paleozoic green rocks was recongnized. This fault cuts overlying gravel and sandy silt layer in one of the trenches.

Keywords: Kokura-higashi fault, Fukuchiyama fault, Fukuoka prefecture, Kyushu, active fault, paleoseismology

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

SSS28-P23 Room:Convention Hall Time:May 27 18:15-19:30

Borehole drillings and reanalysis of the S-wave reflection data across the Kamatoge segment of the Nishiyama fault

MUKAI, Masashi[1] ; MURATA, Kazunori[1*] ; HORIKAWA, Shigeo[1] ; TSUTSUMI, Hiroyuki[2] ; YOSHIOKA, Toshikazu[3]

[1]Suncoh consultants co.,Ltd., [2]Kyoto Univ., [3]AIST

The Nishiyama fault, northern Kyushu, run along the sea of Genkai to Toho village and Asakura city. This fault is divided to three segments, such as Oshima segment, Nishiyama sement and Kamatoge segment. In the Kamatoge segment, there are two faults: the Kamatoge-Koishihara fault, trending NW-SE and the Haki fault, trending NE-SE. The former fault is a sinistral strike-slip fault and the later fault is dextral strike-slip fault. To clarify the subsurface geometry, geological structure and the fault activity, we carried out borehole drillings and reanalysis of the high resolution S-wave seismic reflection data based on the borehole data across the Haki fault in a Haki area.

According to the stratigraphic correlation, two beds of Quaternary strata, consisted of eight beds, are existed only lowland area. We estimated that the Haki fault is run near the low cliff.

In the result of the reanalysis seismic reflection data, the geological structure around the middle of the seismic line is characterized by north-dip (to lowland area) reflection layer in more than 10m depth.

Keywords: Nishiyama fault, borehole drillings, S-wave seismic reflection

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

SSS28-P24 Room:Convention Hall Time:May 27 18:15-19:30

Activity of the Northern Marginal Faults of the Saga Plain

YOSHIDA, Haruka[1*] ; KAGOHARA, Kyoko[2] ; IMAIZUMI, Toshifumi[3] ; SOEDA, Yoshio[4]

[1]Fukuoka Prefectural Ariake High School, [2]Faculty of Education, Yamaguchi University, [3]Graduate School of Science, Tohoku University, [4]West Japan Engineering Consultants, Inc.

The Northern Marginal Faults of the Saga Plain are normal fault zones of up thrown to the north stretching east and west about 19 km. It starts from the vicinity of the Yoshinogari Tateno, Saga Prefecture and continues toward Matsuo Ogi-cho, Ogi. The distribution form of this active fault is a linear trace that extends east to west. Regarding the Northern Marginal Faults of the Saga Plain, Research Group for Active Tectonic Structures in Kyushu ed. (1989) and Nakata-Imaizumi ed. (2002) has certified the active faults along the boundary of the plains and mountains on the north side of the Ariake Sea. However, such as average vertical slip rate and the age of the latest activity of the Northern Marginal Faults of the Saga Plain are unknown because information of the trench survey poor. Therefore, in this study, we had a survey of interpretation of microtopography, field survey and ultra-shallow seismic reflection profiling, to purpose average vertical slip rate, the paleoseismic history as well as the latest activity in the Northern Marginal Faults of the Saga Plain. We have already done a report by the present study, Kagohara et al. (2014) and Imaizumi et al. (2014). In addition, we reaffirmed the distribution of the active fault with a focus on the distribution and shape of microtopography, further, to discuss the activities of these faults band on the basis of the presence or absence of contrast and fault displacement of microtopography. The investigation was conducted from eastern Yoshinogari going west through Kanzaki as far as the Kase River of Saga.

In interpretation of microtopography, we created contour maps of 1m intervals from city planning 1:2500 maps. And we used aerial photographs of scale of 1 per million taken that GSI was taken in the 1960s. Also, we conducted a field survey, including simple boring survey and ultra-shallow seismic reflection profiling.

Resulting in, terraces surface classification of the north portion of the Saga plain has been divided into 7 side of as follows:[the higher than] H, M1, Aso-4pyroclastic flow depositional surface, M2, L1, L2 andL3. Also, light of the comparison with the terraces classification diagram studied (the late Nagaoka originals; Shimoyama, 1999; Shimoyama et al., 1999, 2010, etc.) so far, each of the formation age is as follows. H surface MIS7 equivalent, M1 surface is located in the lower Aso-4 pyroclastic flow deposition surface, it is MIS5e equivalent of last interglacial period, Aso-4 pyroclastic flow deposit surface is 8.9ka and M2 surface is MIS 5a equivalent the formation age from such be covered discordance Aso-4.

Further, L1 surface in terms of the most widely distributed in this study area, it is the Last glacial epoch (MIS 2-4 equivalent) because AT(26-29ka) was sandwiched directly above emerged surface, L2 surface is MIS 1 equivalent for just above the K-Ah (7.3ka) on emerged surface, L3 surface is MIS 1 equivalent lower than L2 surface.

In these L2 surface was observed tectonic bulges lie on the southern side of the known fault trace that continues in the east-west direction. These tectonic bulges are anticline-like, decrease flexure to the south and these states can be read also from the detailed contour map. According to surface exploration, these tectonic bulges have slightly tilted to be confirmed visually. In addition, a simple boring survey around the L2 side with these tectonic bulges, was carried out plurality of places in the hanging wall side footwall side of the fault trace. As a result, relative uplift side of the fault trace on L2 surface in Kawakubo Saga city (altitude about 5m), K-Ah was found in depth 102˜105cm, and AT was found in depth 120 ˜126 cm. For this presentation, we got some results by drilling survey, surface exploration and Ultra-shallow seismic reflection profiling. So we described the discussion on the activities of the active faults in the Northern Marginal of the Saga Plain.

Keywords: Northern Marginal Faults of the Saga Plain, normal fault, large-scale geographical map, tectonic bulge, interpretation of microtopography

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

SSS28-P25 Room:Convention Hall Time:May 27 18:15-19:30

Morphological features of offshore extension of the Futagawa-Hinagu fault zone

YAGI, Masatoshi[1*] ; SAKAMOTO, Izumi[1] ; FUJIMAKI, Mikio[2] ; NEMOTO, Kenji[1]

[1]Tokai University, [2]Coastal Ocean Reseach Co,LTD

Futagawa-Hinagu fault zone (mainly right -lateral strike-slip faults) extends from Aso volcano to the Yatsushiro-sea (The Headquarters for Earthquake Research Promotion, 2002). A number of sub-aerial faults exist in the Yatsushiro-sea.

In acroteric part of strike-slip fault annihilation mechanism, develop complex structures (e.g. Kakimi and Kato, 1994). To comprehend these structures, it is necessary construct the research technique with three-dimensionally and high precision (Abe and Aoyanagi, 2004).

We have carried out the high-resolution seismic surveys with a series of cross sectional observations at the Yatsushiro-sea. Survey area divided into two sub-areas 1) North eastern area, and 2) South western area. We describe results for each sub-area as follow:

Sub-area 1

Main fault (MA fault) with NE-SW trending is distributed in this area. In-cross-sections, sub-vertical fault deformed the seafloor and sediments. Also, observed the flower structure. And displacement of faults becomes smaller to the south.

Sub-area 2

MA fault splayed off here. Almost these faults had normal components and forming a graben structure.

As described above, we have captured the features of the deformation structures, three-dimensionally.

Keywords: Futagawa-Hinagu fault zone, right-lateral strike-slip fault, flower structure

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

SSS28-P26 Room:Convention Hall Time:May 27 18:15-19:30

Recurrence interval analysis along the strike-slip Xianshuihe-Xiaojiang Fault System: by Coulomb stress change history

YAN, Bing[1*] ; TODA, Shinji[3] ; LIN, Aiming[2]

[1]Graduate School of Science and Technology, Shizuoka University, [2]Department of Geophysics, Graduate School of Science, Kyoto University, [3]International Research Institute of Disaster Science, Tohoku University

Stress-triggering theory of earthquakes has been generally concerning to evaluate earthquake interactions in the past two decades. Evolution of stress change deduced from the sequences of great earthquakes along fault offers crucial quantitative restriction to the understanding of earthquake cycles.

The Xianshuihe-Xiaojiang Fault System (XXFS) is a typical left-lateral strike-slip fault that has triggered many large historical earthquakes, including the 2010 Mw 6.9 Yushu earthquake in the central Tibetan Plateau. Thirty-five M ? 6.5 earthquakes have been recorded along the ca. 1500-km-long XXFS since 1327, which provides an unsurpassed opportunity to study the stress change history. To assess the recurrence interval and seismic hazard of the XXFS, we analyzed the Coulomb stress change history along this fault system using elements including the rupture lengths caused by the 35 events, GPS slip rate and simplified fault geometry. The results of previous paleoearthquake investigations along the XXFS are introduced into the Coulomb stress change history to examine the earthquake recurrence characteristics. The southeastern segment of the Xianshuihe Fault Zone expresses recurrence interval of characteristic earthquake model, which is consistent with the historical earthquake records and result of paleoseismic investigations. Comparatively, the northwestern segment of Xianshuihe Fault Zone displays a characteristic of clustered earthquake model. Modeling of Coulomb stress change revealed that the earthquake recurrence model along the strike-slip XXFS is of multiplicity.

Keywords: Xianshuihe-Xiaojiang Fault System, seismic modeling, Coulomb stress change, recurrence interval, seismic hazard