Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-01 Room:303 Time:May 22 09:00-09:15

Revised hypocenters of Two Destructive Earthquakes in Meiji Era

Ritsuko S. Matsu'ura[1*]

[1]ERC, ADEP

For earthquakes from 1885 to 1922, the catalogue by Utsu (e.g. Utsu, 1979) has been widely used. We have been collecting additional information about earthquakes of Meiji and Taisho era to add events to the catalogue on behalf of the Headquarters of Earthquake Research Promotion (HERP) to increase seismicity information of old terms. On the way, I noticed the hypocenters of 1894 Oct. 7th in Kanto district and 1911 June 15th near Kikaijima Island are different from the current catalogue. Here I report these new hypocenters.

The event on Oct 7th, 1894 is M6.7 and located at the northern part of Tokyo Bay, and the inter- or intra-plate earthquake. It was believed an aftershock of Meiji Tokyo Earthquake on June 20th, 1894. Utsu used seismic intensities and amplitudes observed at only five stations of the Central Meteorological Observatory (CMO) to determine the size and the hypocenter of this event. Ishibe et al. (2012) concluded this event as the earthquake of intra-PAC-plate from the seismic intensity contour map made by the CMO (1897). However, when we make the distribution of seismic intensity reported in Japanese Gazette (1894) and the Meteorological report at Lighthouses (1894), it is different from the intensity distribution of an intra-plate earthquake of PAC as the one under the northeastern end of Tokyo Bay on July 23rd, 2005 M6.0. It resembles to the M5.9 intra-plate event under the Uraga Channel on Feb. 2nd, 1992. I propose the new hypocenter for this event as: 35.2 deg. N, 139.8 deg. E, 90km depth. The new hypocenter assures that this event is not an aftershock of Meiji Tokyo Earthquake.

For the event on June 15th, 1911, Imamura (1913) obtained epicenter off the north-east of the Amami Island, while Shida (1911) and Gutenberg and Richter (1954) determined an epicenter off the west of the island. Goto (2013) confirmed that the arrival time data show an epicenter near that of Imamura's. For this event, Utsu (1979) showed some hesitation, and concluded that the epicenter is the east off the island and the depth is 100km, and M8.0. I examined all information available on seismic intensities, damage reports, and tsunami reports.

I also checked waveforms at Mizusawa, Osaka, Florence, and Riverview. I compared waveforms of this event to several other events, which occurred near Amami Islands, and concluded that the 1911 earthquake is shallow and the largest observed inter-plate event in the northern part of Ryukyu trench. I would not move the epicenter from Utsu's, 28 deg. N, 130 deg. E, but change depth to Shallow in his term, which is equivalent to about 40km in this area. The reason that Gutenberg obtained 160km depth for this event is that he interpreted the sea-surface reflection phase as the solid earth surface reflection. We will continue the effort to compile information of old events as much as possible, including waveform data remained in smoked papers.

I appreciate Dr. Tamura at Mizusawa Observatory, Dr. Ferrari and staffs at INGV, Italy, and Dr. Barton and Mr. Harrington at Geoscience Australia, for preserving old records available for research. This research was supported by HERP, MEXT of Japan.

Keywords: Utsu's Catalogue, aftershock of Meiji Tokyo Earthquake in 1894, Kikaijima Earthquake in 1911, information in waveforms, large earthquake in Ryukyu Trench, the earthquake on Oct. 7, 1894

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-02 Room:303 Time:May 22 09:15-09:30

Spatial distribution of faults and folds in the offshore extension of the Sarobetsu fault zone, Hokkaido, Japan

Shintaro Abe[1*], Yasuhito Uchida[2], Ryoyu Arai[3], Yukinobu Okamura[1]

[1]AIST, [2]HRO, [3]KGE Co.,Ltd

We carried out a marine geological investigation on an offshore extension of the Sarobetsu fault zone, Hokkaido, Japan. The main purpose of this study is to clarify the total length of the fault zone and characterization of recent faulting.

On the land, the Sarobetsu fault zone is fault related folds deformed by east dipping blind reverse fault, and the total length of this fault zone is 44 km.

We conducted 12 lines of high-resolution multichannel seismic reflection survey and 7 lines of Single-channel seismic reflection survey to recognize the detailed structure of the faults and folds. The reflection profiles depict the geological structure with extremely clear images.

The reflection profiles showed that the geological structure of the offshore area is characterized by the fold belt along the eastern margin of the Rebun trough. The shape of the fold is asymmetric, and suggesting fault related folds that has been deformed by east dipping blind reverse fault as with land. Although the top of the anticline has been eroded significantly, height difference with tilting is confirmed on the seafloor and surface erosion during the last glacial period (about 18 000 years ago) respectively. So the deformation was recognized in the Holocene layer, thus this fold belt is inferred to be active.

The length of the fold belt is estimated to be about 60 km based on our results of the survey. However, the latest activity age of the blind revers fault forming the fold belt is uncertain.

Keywords: Sarobetsu fault zone, offshore, fault, fold, active structure, high-resolution seismic reflection survey

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-03 Room:303 Time:May 22 09:30-09:45

Submarine active fault map of the eastern part of Sea of Japan

Mitsuhisa Watanabe[1*], Takashi Nakata[1], Hideaki Goto[2], Yasuhiro Suzuki[3], Azusa Nishizawa[4], Daishi Horiuchi[4], Yukari Kido[5]

[1]Toyo Univ., [2]Hiroshima Univ., [3]Nagoya Univ., [4]apan Coast Guard, [5]JAMSTEC

We executed tectonic geomorphological research on the submarine topography in the eastern part of Sea of Japan. It is essential to examine submarine active faults in order to make an accurate estimate of future large earthquake and tsunami in this seismically active region. We investigated feature of active structures in this region based on 3D anaglyph images, which have 250 m resolution. There are extensive long active faults trending in NNW-SSE direction in the northern part of the region. In the southern part, high-density active faults in NNE-SSW direction are dominant. Several active fault cut the deep sea floor north of Awashima Island forming a clear antecedent valley of the deep sea channel. The source fault of the large earthquake in 1983 is exactly mapped. However, the active faults originated the 1993 earthquake has gone missing.

Keywords: anaglyph, submarine active fault, large historical earthquake, tsunami, eastern part of Sea of Japan

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-04 Room:303 Time:May 22 09:45-10:00

The latest fault event of the Kochien fault of the Tokachi-heiya fault zone, southeastern Hokkaido, Japan

Takashi Azuma[1*], Masashi OMATA[2], Yoshiki MORI[2], Yorihide KORIYA[2], Tomoya SATO[2], Takaaki IWASAKI[3]

[1]Active Fault and Earthquake Research Center, AIST, [2]Crearia Inc., [3]ias

Kochien Fault is NNW-SSE trending reverse fault, bounding between the Hidaka Range and the Tokachi Plain. We conducted a paleoseismological trench survey and drilling survey at two sites, Kashuunnai and Nozuka, on this fault. At Kashuunnai trench, a high angle reverse fault was observed, which displaced gravel layer deposited after Spfa-1 (30-40 ka) and covered with silt layer with the 14C age of 12 ka. Vertical displacement of this gravel layer was 5 m and a height deference of basement rock between both sides of fault was also 5 m from the result of drilling survey. At Nozuka trench, a humic silt layer flexure toward upstream side was observed. This deformed layer had 14C ages older than 40 ka and covered with gravel layer with the age younger than 9 ka. Vertical displacement of deformed layer was 3 m on the trench wall and a height deference of basement rock was also 9 m. Based on these results, we concluded that the Kochien fault acted only once between 40 ka and 12 ka, whereas the previous study indicated a possibility that two events occurred after 20 ka. Amount of vertical displacement during the last fault event was 3-5 m.

Keywords: active fault, paleoseismological trench survey, line drilling survey, fault activity, 14C dating, Hokkaido

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-05 Room:303 Time:May 22 10:00-10:15

Subsurface structure and tectonic geomorphology along the Western marginal fault zone of the Kitakami lowland

Kyoko Kagohara[1*], Hideki Kosaka[2], atsushi Miwa[3], Toshifumi Imaizumi[4]

[1]Yamaguchi University, [2]Kankyo-Chishitsu Ltd., [3]OYO Co. Ltd., [4]Graduate School of Science, Tohoku University

The Western marginal fault zone of the Kitakami lowland is an active reverse fault zone that extends for about 70 km along the Quaternary volcanic front of the northeast Japan arc. We conducted an integrated survey including geomorphic interpretation, surface geological mapping, seismic reflection and gravity surveys, on the Tengumori-Dedana Fault group and Ichinoseki-Ishikoshi Flexure, to clarify the structural linkage in the Kitakami lowland. The Tengumori-Dedana Fault group is composed by several active faults in the southern portion of the fault zone. The Ichinoseki-Ishikoshi Flexure develops from southern end of the fault zone to high seismicity zone in northern Miyagi prefecture.

Keywords: Western marginal fault zone of the Kitakami lowland, seismic reflection profiling, gravity survey, tectonic geomorphology, subsurface structure

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-06 Room:303 Time:May 22 10:15-10:30

Relationship between inferred Quaternary faults and abrupt depth changes of layers in the Tokyo metropolitan area

Isamu Toyokura[1*], Sumio Aoto[5], Akio Kawada[6], Hiroshi Sudou[3], Kenzo Fukui[2], Tatsuji Matsuzaki[7], Heitarou Watanabe[4], Haruo Yamazaki[8]

[1]Geo-Toyokura PE's Office, [2]Kawasaki Geological Engineering Co., Ltd., [3]Daiwa Exploration & Consulting Co.,Ltd., [4]OYO Corporation, [5]Kiso-Jiban Consultants Co.,Ltd., [6]Suncoh Consultants Co. , Ltd., [7]Asano Taiseikiso Enegineering Co.,Ltd., [8]Tokyo Metropolitan University

Our group has been studying inferred Quaternary faults in the Yamanote Upland in the Tokyo metropolitan area since 2007. We will discuss relationships between abrupt depth changes of layer distribution described in geologic profiles, which are published after construction works of some subways, and those inferred Quaternary faults in the area.

Keywords: Quaternary fault, active fault, metropolitan area, subway construction, abrupt depth change of layer distiribution, height difference

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-07 Room:303 Time:May 22 11:00-11:15

Existance of An Active Fault Zone along the Izu-Toho Tectonic Line Inferred from the Marine Geomorphology

Haeng Yoong Kim[1*], YOSHIDA, Akio[1], KOBAYASHI, Akio[2]

[1]Hot Springs Research Institute of Kanagawa Prefecture, [2]Meteorological Research Institute

Having scrutinized topography of the seabed in the region southeast-off Izu Peninsula, we found out that submarine reverse faults inclining to the west exist along the Izu-Toho Tectonic Line (ITTL). The ITTL was proposed by Okayama (1968) as the boundary dividing the Izu crustal block and the seabed of Sagami Bay that subducts beneath the Kanto region. This indicates that the ITTL is an active tectonic line. In the research we used the bathymetric data with 500m mesh and 10m or 100m contours published by Hydrographic and Oceanographic Department. We suggest that shortening of the distance between the southern tip of the Izu Peninsula and Shikine-jima and Nii-jima after the 2011 Tohoku-oki earthquake may be related to the existence of the faults.

Keywords: Izu Peninsula, Izu-Bonin Arc, Active Fault Zone along the Izu-Toho Tectonic Line, Marine Geomorphology, Izu Terrain, GNSS

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-08 Room:303 Time:May 22 11:15-11:30

Coseismic uplift of the southern of the Izu Peninsula, central Japan, based on emerged marine sessile assemblages

Akihisa Kitamura[1*], Masato Koyama[2], Koji Itasaka[3]

[1]Institute of Geosciences, Shizuoka University, [2]Faculty of Education, Shizuoka University, [3]Shizuoka Prefecture Emergency Management Department,Emergency Management Strategic Division

Based on faunal compositions and outcrop elevation distributions, we identify three zones of emerged sessile assemblages in sea cave at the southern end of the Izu Peninsula, central Japan. The uppermost Zone I is hard, massive shellcrust exposed between 3.5 and 2.7 m above present mean sea level, and consists mainly of barnacles that inhabit the upper tidal zone. Zone II occupies an elevation range of 2.7-2.0 m and is dominated by well-preserved individuals of barnacles found in the upper tidal zone. Zone III crops out from 2.0 to 1.0 m in elevation and is characterized by abundant calcareous tubes of polychaetes found in the lower intertidal zone. By combining the analysis of faunal compositions with the radiocarbon dating of samples from Zones I, II and III, we suggested that coseismic uplifts took place at AD 640-740 (1.2-1.5 m uplift), AD 1030-1180 (0.2-0.4 m uplift), and AD 1460-1560 (2.5 m uplift). The age range of the youngest uplift includes the times when known earthquakes occurred, in 1495 and 1498.

Keywords: southern of the Izu Peninsula, Holocene, coseismic uplift, emerged marine sessile assemblages

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-09 Room:303 Time:May 22 11:30-11:45

Geological examination in the southwest end extension portion of a Sanageyama-kita fault,Central Japan

tatsujiro Nozawa[1*], Tomonori Hasegawa[1], Takeshi Minaguro[1], Atsumasa Okada[2], Yasuhiro Suzuki[3], Takeshi Makinouchi[4], Tetsunobu Nakane[5]

[1]Tamano Consultants Co., Ltd., [2]Ritsumeikan University, [3]Nagoya University, [4]Meijo University, [5]none

Let the Sanageyama-kita fault be about 22-km active fault extended in the direction of northeast - southwest from Aichi Prefecture to Gifu Prefecture. The principal part of this active fault has clear right gap geographical feature in mountain land, and the proof of the active fault is checked by the trench and the outcrop. On the other hand, the southwest ends of this fault are steep ranges of hills, such as Seto, Toyota, and Nagakute, and since clear fault topography is not accepted, it has been thought that the southwest end of a Sanageyama-kita fault is to the boundary of mountain land and a steep range of hills.

In recent years, development of a road, a railroad, residential land development, etc. goes to this steep range of hills, and accumulation of geological information is following boring data, a new outcrop, etc. Then, as a result of reexamining by performing collection, such as the existing geological survey report, it has checked that extension of a Sanageyama-kita fault had reached to a steep range of hills.

The southwest part of a Sanageyama-kita fault is applied to an east mountain path town from Shirasaka-cho, Seto-shi, and is very clear. It had branched from Kaisho-cho, Seto-shi to two, and, as for the north thing, the southern thing was carried out to to Yoshino-cho, Seto-shi to near the boundary in Seto and Toyota.

About the thing of the north side, the perpendicular displacement magnitude of the base of a Seto clay layer or the Tokai layer group was examined.The fault outcrop was checked in maintaining the fixed difference-in-elevation difference of the inside and outside of 50 m, and continuing from the mountain land to a steep range of hills, and a construction site. The Sanageyama-kita fault is continuing to a steep range of hills.

Moreover, as for the thing on the south, the fault outcrop accompanied by a crush zone is checked at land developed for housing lots or a mining site.

From these things, it was concluded that the southwest end of the Sanagyama-kita fault became long about 2.5 km.

Keywords: Active fault, Steep range of hills, Perpendicular displacement magnitude, Fault outcrop, Geological examination

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-10 Room:303 Time:May 22 11:45-12:00

Surface trace and geologic structure of the Kurehayama fault in the downtown area of Toyama City, north-central Japan

Akira Takeuchi[1*], MURAO, Hidehiko[2], Shigekazu Kusumoto[1], MURACHI, Kasumi[3]

[1]Graduate School of Science and Engineering, University of Toyama, [2]Murao Chiken Co., [3]Faculty of Science, University of Toyama

The Kurehayama fault belt is an 35 km long, reverse fault running along the northwestern margin of Toyama Plain and the Hamakurosaki Spur, Toyama Bay. Since 1995, seismic reflection survey, drilling, trenching, and pit-excavation have been carried out along the central and southern segments of the fault. Although the surface trace of the master Kurehayama fault has been estimated by the previous studies, the underground structure in the downtown area of Toyama City remained uncertain. Therefore, the government of Toyama City had conducted seismic reflection surveys along three exploration lines in 2011-2012. This study re-examined those data of these survey lines and output into interpreted profiles in comparison to the acoustic profiles in the Toyama Bay area.

As for the urban Lines A and B, their terminations are located almost identical with the surface fault trace estimated from the tectonic landform, and the fault plane strikes N42?E and dips about 45?NW. While, Line C dose not illustrate clear fault in the shallow depth less than 200 meters. However, the deeper structure more than 200 down to 1100 meters a northwesterly dipping reverse fault was recognized to make a trishear-like monoclonal flexure. These features of Line C are almost consistent with those of Line 10M-A2 and Line 10M-1the former analytical results in the Toyama Bay area.

The previous reflection surveys on land areas revealed the shallow structures of the Kurehayama fault less than 500m in depth, while the coastal Line C did up to a depth about 2km in the urban area, and the master fault was located on the just extension of its bay-bottom fault trace. It can be concluded that the master fault is characterized by accompanying an asymmetric anticline or monocline flexure in both land and sea regions, especially along the segment from the downtown Toyama up to the Hamakurosaki spur.

Keywords: active fault, seismic reflection profile, Toyama Bay, Kurehayama fault, fault related fold, Toyama Plain

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-11 Room:303 Time:May 22 12:00-12:15

Holocene activities of the Hachiman fault upstream of the Nagara River, Gifu Prefecture, central Japan

Yasuo Awata[1*], Tomoo Hashimoto[2], Takashi Hosoya[2]

[1]Geological Survey of Japan, AIST, [2]Chuo Kaihatsu Co.

The Hachiman Fault is a NW-SE striking, 20-25 km-long, left-lateral strike-slip fault at the upstream district of the Nagara River, western Gifu Prefecture, central Japan. Although the fault running through a mountainside have caused a series of offset valleys, fault scarp on the river terrace surfaces is obscure. We conducted paleoseismic investigations by trench excavation at three sites on the fault.

The Tantawa site is located next to a small shutter ridge on the middle of the fault. A 10-m-long, 2-m-wide and 2m-deep trench was dug between the western slope of the ridge and the fault sag. The Okumino Acidic Igneous Complex of the Mesozoic era is exposed in the eastern half of the trench. The western part of the trench consists of gravel bed and overlying 1.5-m-thich organic sediments. Lenticular soil layers rich in granules and small pebbles are developed at the upper and lower horizons of the organic sediments. 5-m-wide fault zone consist of extensional fractures pass through the middle and eastern part of the trench. 0.5-m-wide main fault border the western rim of the fault zone, and a series of NW-SE trending, west-side-down fractures spreads towards southeast in the eastern half of the fault zone. The horse tail arrangement of the extensional fractures is consistent with left-lateral strike-slip movement of the fault. The main fractures cut the middle of the organic sediments and unconformably overlain by the upper gravelly soil layer that seems to be a colluvial wedge right after a faulting event between 3700+-30 yBP. and 5280+-30 yBP. Another lenticular gravelly soil bed at the lower part of the organic soils is possibly a colluvial wedge related to the penultimate faulting events between 6580+-30 yBP and 8280+-40 yBP.

The Kossa site is located on an alluvial fan dammed up by a small shutter ridge in the northern-middle of the fault. The upper part of the alluvial fan deposits changes into massive gravelly sand bed dated 4570+-40 yBP in the fault sag. On the upstream side of the shatter ridge, gravel beds of the alluvial fan deposits gently tilt toward the upstream of the fan. It is unclear if these faces change and tilting structure were caused by the movement of the Hachman fault or not. The Aburasaka site on the northern fault is located on a terrace surface once used as a skiing area. Trenches across a ENE facing gentle slope exposed the man-made bank of a ski course and underlying terrace deposits without any deformational structure.

Our trench surveys have revealed two paleoseismic events of the Hachiman fault. The most recent event probably occurred between 3930 Cal yBP and 6180 Cal yBP, and the penultimate possibly between 7430 Cal yBP and 9400 Cal yBP.

Keywords: Nagara-gawa fault zone, Hachiman fault, active fault, paleoseismicity, most recent event

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-12 Room:303 Time:May 22 12:15-12:30

Relationship of slip plane and element distribution in the inactive fault zone: an example of the Butsuzo Tectonic Line

Tomoyuki Ohtani[1*], IGETA, Shunsuke[1], Satoru Kojima[1]

[1]Dept. Civil Eng., Gifu Univ.

Mineralogical and geochemical studies of the recently slipped fault gouges might enable us to specify the recently slipped fault gouges in basement rocks. To understand the characteristics of their mineralogical and geochemical features, it is important to compare them with an inactive fault zone. The purpose of this study is to compare previous studies with the characteristic features of the fault gouge in the Butsuzo Tectonic Line based on field survey, XRD, XRF and SEM-EDX analyses.

The studied site is located in Taiki-cho, Mie prefecture, is reported by Kato and Saka (1995). The Butsuzo Tectonic Line is the boundary fault of the Chichibu and Shimanto Belts, and is not recognized as an active fault by Active Fault Research (1991). Attitude of the fault zone is N62W30N, and its thickness is 0.9 m. The hanging wall of the fault zone is the mudstone with sandstone blocks in the Chichibu Belt, and the footwall is the mudstone with sandstone blocks in the Shimanto Belt. The fault zone consists of the fault gouge zone in a thickness of a few cm and the fault breccia zone. The latter is divided into two zones based on their color; light gray fault breccia zone and dark gray fault breccia zone. A part of the light gray fault breccia zone shows light yellow color, and this part is connected to a fracture in the hanging wall. Both fault breccia zones include blocks with quartz and calcite veins.

The samples collected from the fault zone are analyzed by XRD, XRF and SEM-EDX. The results show that 1) dolomite is mainly included in the fault gouge and the light gray fault breccia zones, 2) siderite is mainly in the dark gray fault breccia zone, 3) no smectite in fault zone, 4) no concentration of Mn and 5) Fe concentrates in the light yellow part in the light gray fault breccia zone and goethite was detected. These results are not consistent with the previous studies on the active faults (e.g. Ohtani et al, 2012) whose results are 1) Mn is concentrated and oxidization have been occurred in the recently slipped fault gouge and 2) smectite is included. These differences might be clues to differentiate the recently slipped fault gouge in basement rocks from the others.

References

Active Fault Research, 1991, Active Faults in Japan, University of Tokyo Press, 440pp.
Kato and Saka, 1995, Gakujutsukenkyu Ser. Biol. & Geol. Sch. Edu. Waseda Univ., 44, 1-8.
Ohtani et al., 2012, Abst. Japan Earth Planetary Sci. joint meeting, SSS35-04.

Keywords: Butsuzo Tectonic Line, fault zone, geological fault, element distribution

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-13 Room:303 Time:May 22 14:15-14:30

The Kego Fault and subsurface structure in the Fukuoka Plain analyzed based on borehole data

Katsumi Kimura[1*], Kou Yoshihide[1], Yuki Hanashima[2]

[1]AIST, Geological Survey of Japan, [2]Univ.of Tsukuba, Graduate school of Life and Environment Science

The borehole database including about 2,438 digital borehole data have been build up for constructing the subsurface structure of the Fukuoka Plain, in corporation with local government offices and the Kyushu Ground Information Association.

The 3D geologic model of the Fukuoka Plain based on the borehole database offers a good example to display the strike-slip basin structure bounded by the Kego active fault on its southwest side. The basin is characterized by west to southwestward tilting of the basement covered by the Middle Pleistocene to Holocene deposits. The basement rocks consist of Paleogene sedimentary rocks and Cretaceous granite. The basin fills are divided into four stratigraphic units, that is, and the Nakabaru gravel member, the Suzaki member, the Aso-4 pyroclastic flow deposits, the Otsubo sand-gravel member, and the Holocene incised-valley fills (called the Chuseki-so), in ascending order.

Keywords: Kego Fault, Fukuoka Plain, borehole data, subsurface structure

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-14 Room:303 Time:May 22 14:30-14:45

Fault model of 1596 Keicho Bungo Earthquake around Beppu Bay, Kyushu, Japan

Keiji Takemura[1*], Kenji Satake[2], HIRAI, Yoshito[3], Intellectual members for Disaster Prevention Counter-measure of Oita Prefecture[4], Shunsuke Hamada[5]

[1]Graduate School of Science, Kyoto University, [2]Earthquake Research Institute, University of Tokyo, [3]Oita Prefecture Ancient Stage Historical Archives, [4]Oita Prefecture, [5]Oyo Corporation

<Introduction> Oita Prefecture is reviewing on damage estimation by earthquake and tsunami from Nankai Trough Earthquake, Earthquake in Beppu Bay and Suonada Earthquake in Seto Inland Sea. Members of Intellectual Committee for Disaster Prevention Counter-measure Committee of Oita Prefecture are Keiji Takemura, Kenji Satate, Yoshito Hirai, Kazuro Hirahara, Noboru Chida, Muneharu Kudo, Tomotaka Iwata, Kenji Kikuchi, Takanori Iwao, Junko Murano. This presentation is concentrated on the 1596 Keicho Bungo Earthquake when it occurred on fourth of September in 1596 in Beppu Bay. Hatori (1985) estimated tsunami heights around the Bappu Bay on the basis of historical documents and field evidences, and magnitude 6.9. Ishibe and Shimazaki (2005) estimated the source of tsunami by 1596 Keicho-Bungo Earthquake.

<Height of 1596 Keicho-Bungo Tsunami> There are 18 historical records on earthquake and tsunami accompanied by 1596 Keicho-Bungo Earthquake in this review. Tsunami heights are estimated at the sites of Kitsuki (Hachiman-Natamiya Shrine), Beppu-mura, Nishi-Oita (Okinohama), Fuchu, Saganoseki (Seki-Jinja) on the basis of description of historical records and field survey. Each tsunami height is 6m, 4-5m, 4-5m, 4-5m and 4-6m respectively, and used as an evidence by simulation.

<Fault model of 1596 Keicho-Beugo Tsunami >

In and around Beppu Bay, Median Tectonic Line (Hoyo-strait segment), East part of Beppuwan-Hijiu Fault zone (including Beppu Bay Central Fault), East part of Beppu Graben Nanen Fault (including Asamigawa Fault and Funai Fault etc) are distributed. Recent activity of Beppu Bay Central Fault is correspondent to the 1596 Keicho-Bungo Earthquake by the active fault survey using sonic survey and stratigraphy of sediment (Okamura et al., 1992 etc). Firstly, tsunami height is simulated by independent activity of fault system in Beppu Bay. (1) in the case of activity East part of Beppuwan-Hijiu Fault zone by the Headquarters for Earthquake Research Promotion, (2) Beppu Bay Central fault and Kitsuki-oki Fault system of East part of Beppuwan-Hijiu Fault zone. As a result, calculation by independent activity of each fault in Beppu Bay is not obtained the tsunami height by historical records as indicated by Ishibe and Shimazaki (2005). Afterwards, we checked the following third model (3) .(3) Two cases of Simultaneous activity of Median Tectonic Line (Hoyo-strait segment), East part of Beppuwan-Hijiu Fault zone (including Beppu Bay Central Fault), East part of Beppu Graben Nanen Fault (including Asamigawa Fault and Funai Fault etc) First case is all together activity of three fault system, and the simulated tsunami height is concordant with that of historical record except for the data at Kitsuki (Hachiman Natamiya shrine). Second case is the time difference ((about 8 minutes)) activity in the order from activity of Median Tectonic Line (Hoyo-strait segment) at first and secondly East part of Beppuwan-Hijiu Fault zone (including Beppu Bay Central Fault), East part of Beppu Graben Nanen Fault (including Asamigawa Fault and Funai Fault etc) The simulated tsunami heights are satisfied with them at the whole site recorded by historical document by this simulation. In the future, Oita Prefecture will have plan to adopt <time difference activity model> for estimation of tsunami height and making map showing areas with the potential for flooding from tsunami, and draw up the damage prediction.

Reference:

T. Hatori(1985) Field Investigation of the 1596 Bungo Tsunami along the Coast of Beppu Bay, Kyushu. Bulletin of the Earthquake Research Institute, University of Tokyo, 60, 429-438.

T. Ishibe and K. Shimazaki(2005) Estimation of the Source of Tsunami Accompanied by the 1596 Keicho-Bungo Earthquake. Rekishi Jishin, 20, 119-131.

M. Okamura et al. (1992) Submarine active faults in the northwestern part of Beppu Bay, Japan: On a new technique for submarine active fault survey. Mem. Geological Soc. of Japan, 40, 65-74.

Keywords: 1596 Keicho-Bungo Earthquake, tsunami, Beppu Bay, fault model

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-15 Room:303 Time:May 22 14:45-15:00

Source fault models of the 1768 earthquake and the 1791 tsunami near Okinawa-jima, central Ryukyu.

Mamoru Nakamura[1*], Ayano Kinjou[1]

[1]Faculty of Science, University of the Ryukyus

Central Ryukyu has been assumed as low risk area for interplate earthquakes because interplate coupling is weak and large earthquakes (about M8.0) had not been recorded historically for about 300 years. However, two historical tsunamis, which occurred near Okinawa Island on 1768 and 1791, were recorded in the old document 'Kyuyo' (formal chronicles of Ryukyu). I investigate the source fault model of two tsunami event using numerical simulations of tsunami and earthquake shaking, and show that their events would be interplate earthquakes.

One earthquake occurred at noon of July 22th, 1768. The rockwalls of castle, grave of royal family were collapsed by the earthquake shaking in Shuri area, Naha, Okinawa Island. The rockwall of temple was damaged in Urasoe. After the shaking the tsunami arrived Naha port and Zamami Island. Recorded tsunami heights were about 1 m at Naha port. Nine houses and rice fields were damaged by the inundation of the tsunami in the Zamami Island. Estimated tsunami heights were 4-5 m in Zamami Island. The numerical modeling of tsunami and the estimation of earthquake shaking using empirical formula were employed, and the fault parameters of the 1768 earthquake were estimated. The faults were set to Okinawa Trough (M7.4 normal faults), Kerama Gap near Zamami Island (M7.4 normal faults), and Ryukyu Trench (M7.9 thrust faults). The computed tsunami heights and intensities of ground shaking of the M7.9 interplate earthquake model are consistent with to the recorded.

Another tsunami was also recorded in the Kyuyo. The abrupt abnormal increases of sea-level were recorded in the Okinawa Island on May 13th, 1791. The recorded tsunami heights were 1.5 m at Naha port, 2 m at Motobu (Toguchi), and 11 m at Yonabaru (eastern coast of Okinawa Island). Large historical earthquakes have not been reported around the Pacific Ocean in this period. The numerical simulation of tsunami was employed to estimate the fault parameters of the 1791 tsunami. The computed tsunami heights of the M8.2 interplate earthquake model, whose top is along the Ryukyu Trench, are consistent with the recorded ones.

Keywords: Ryukyu Trench, tsunami, hiostorical earthquake

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-16 Room:303 Time:May 22 15:00-15:15

Reevaluation of the offset of the Great Wall caused by the ca. M 8.0 Pingluo earthquake of 1739, Yinchuan graben, China

Aiming Lin[1*], Gang Rao[1], Wangbin Gong[2], Jianmin Hu[2]

[1]Department of Geophysics, Graduate School of Science, Kyoto Univ., [2]Institute of Geomechanics, Chinese Academy of Geological Sciences, China

The study of large-magnitude earthquakes that occurred prior to the availability of routine instrumental measurements relies mainly on the analysis of historical documents and field observations. Significant uncertainties often exist in relation to the location of the epicenter, the magnitude, and the actual extent of damage, including the number of fatalities, caused by individual historical earthquakes, because records generally focused on the effects in the restricted regions that were settled. Field observations of the geologic effects of large historical earthquakes provide direct evidence of the coseismic ground deformation and seismic intensity of these large-magnitude events, and can therefore help to improve our understanding of the dynamic mechanisms associated with seismic faulting, and our ability to assess seismic hazards in densely populated epicentral regions.

China is located in one of the most active seismic regions of the world and has experienced numerous destructive earthquakes over its long history. The damage caused by previous large-magnitude earthquakes has been recorded in historical documents, and coseismic ground deformation is locally preserved in ruined ancient buildings such as temples, tombs, and other constructions erected over the past several thousand years (EBASP, 1998; People Network, 2012). Therefore, the ruins of ancient civilizations can sometimes be used to indicate the nature and extent of ground deformation and damage caused by large-magnitude earthquakes.

Previous studies have shown that the Great Wall of China was damaged and offset by the ca. M 8 Pingluo earthquake of 1739 along an active fault zone in the Yinchuan graben, on the western margin of the Ordos Block in northern central China. Based on the apparent displacement, it was concluded that the Great Wall was right laterally offset by 1.45-1.95 m, with a 0.9-2.0 m vertical component, at three locations in this area (He, 1982; Liao and Pan, 1982; Zhang et al., 1986); consequently, the maximum cumulative displacement of the wall was calculated to be 3 m dextral and 2.7 m vertical (Zhang et al., 1986).

However, our recent fieldwork has shown that the Great Wall was probably not affected by the ca. M 8 Pingluo earthquake of 1739, as reported previously. In this study, we reinterprets the offset of the Great Wall on the basis of our new field observations, and attempts to identify the source seismogenic fault that triggered the 1739 M 8 Pingluo earthquake. Our field investigations reveal that (i) the Great Wall was not offset by the ca. M 8 earthquake of 1739, but the wall was, in fact, built on the pre-existing fault scarps; (ii) the Yinchuan-Pingluo fault was most probably the source seismogenic fault of the 1739 earthquake. More work is required if we are to better understand the deformation characteristics of the source seismogenic fault, and also improve our ongoing assessments of the seismic hazard within the densely populated area of the Yinchuan graben.

Keywords: 1739M 8.0 Pingluo (China) earthquake, Great Wall, coseismic surface rupture, active fault, displacement, paleoearthquake

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-17 Room:303 Time:May 22 15:15-15:30

Study Paleoseismology of Cimandiri Fault, Sukabumi, West Java, Indonesia

Supartoyo Supartoyo[1*], Sri Hidayati[1], Emmy Suparka[2], Chalid Idham Abdullah[2], Imam A. Sadisun[2], Nandang[3]

[1]Geological Agency of Indonesia, [2]Institute Technology of Bandung, [3]Indonesian Institute of Sciences

Cimandiri fault lies along the Cimandiri river valley that extends about 55 km from Palabuhanratu Bay to southern part of Sukabumi city. Shuttle Radar Topography Mission (SRTM) and aerial photograph showed lineaments along the valley and associated with the existing of the Cimandiri Fault.

This paleoseismology study is aimed to find out the signs of ancient earthquakes from Cimandiri Fault movement. A trench was dug to ascertain evidence of the ancient earthquakes which can be seen through the wall of the trench. Site of trenching is defined based on field, landform and stratigraphic observations.

Analysis of wall trenching showed a discontinuity of layer (sandy granules, sandy pebbles, sandy clay, clay and paleosols), a minor fault, the deformed of clay and a pattern of the minor of synthetic and antithetic fault. These indicated the evidence of tectonic deformation of ancient earthquakes. Moreover, age analysis of paleosols in the fault zone revealed 2 ancient earthquakes occurred in 1620 moreless 230 BP and 1170 moreless 190 BP (1950). It suggests that Cimandiri Fault can be classified as an active fault.

Keywords: paleoseismology, trenching, paleosols, ancient earthquake

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P01 Room:Convention Hall Time:May 22 18:15-19:30

Active structure beneath the Yufutsu coastal lowland, Hokkaido, Japan

Takanobu Yokokura[1*], Junko Komatsubara[1], Kazuo Yamaguchi[1], Shinsuke Okada[2], Taku Komatsubara[1]

[1]Geological Survey of Japan, AIST, [2]IRIDeS, Tohoku University

1. Introduction

Sato et al.(1998) and Kato et al.(2004) have shown that a fold (an anticline) is concealed beneath the Yufutsu coastal lowland, Hokkaido, which deforms the overlying Cenozoic strata. However there is no information on the fold activity in the late Quaternary. We try to evaluate the activity in the late Quaternary by using a seismic reflection survey and two shallow borings, conducted under the AIST project ”Investigations on Geology and Active Faults in the Coastal Zone of Japan”.

2. Seismic Reflection Profiling

We conducted a 19.7km-long P-wave seismic reflection survey, targetting depths as great as 1000m, along the coast of the Yufutsu lowland, from the Tomakomai West Port, via the Tomakomai East Port, to Mukawa town. In the western part of the survey line crossing the fold, we located shot points densely along the survey line using a MiniVib source with higher sweep frequency to obtain a precise structure and, if possible, to tie following two shallow borings. The processed section provides the following conclusions. Clear reflectors are seen as deep as 1500m. The concealed fold is cumulatively active in the late Cenozoic era. There are two prominent angular unconformities around 80m and 230m in depth above the axis of the anticline. Another broad anticline is concealed around 1000m deep to the west of the above mentioned anticline, suggesting that the front of the thrust fault associated with this fold system may be almost reach to the west end of the seismic section.

3. Boring Survey

We conducted two 80m-long all-core boring surveys named BT1 and YF1 which are located at the axis and at the end of west wing of the anticline respectively. The BT1 core shows Toya tephra (110-120ka) at 19m, and marine sand to mud layers at 26-35m, 50-66m, and 71-80m depth intervals. Particularly marine layer at 52-66m interval is characterized by abundant Fagus pollens. The YF1 core shows Holocene sediments at 0-45m, and marine layers at 45-48m and 57-80m intervals. There is no Fagus-dominant zone in the YF1 core. A pollen zone boundary in a marine layer (subtidal zone) around 28m depth in the BT1 core is correlated to that around 58m depth in the YF1 core. As the boundary is interpreted to correspond to the contemporaneous surface of MIS 7, the anticlinal structure may have vertical displacement rate of 0.1-0.15m/ky in the late Quaternary.

References:

Sato et al.(1998) Jour. Japan. Assoc. Petrol. Tech., 63, 323-324.
Kato et al.(2004) Tectonophysics, 388, 75-84.

Keywords: active structure, Yufutsu, boring, seismic reflection survey

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P02 Room:Convention Hall Time:May 22 18:15-19:30

Paleoseismic activity of the Kuromatsunai teichi fault zone, based on fault outcrop observations

Hideki Kurosawa[1*], Hideki Kosaka[2], atsushi Miwa[1], Kyoko Kagohara[3], Toshifumi Imaizumi[4]

[1]OYO Corporation, [2]Kankyo chishitsu Co., [3]Yamaguchi University, [4]Tohoku University

The Kuromatsunai teichi fault zone is a 32 km-long, reverse fault zone which develops into the Kuromatsunai Lowland, southwest Hokkaido. This fault zone consists of a series of reverse faults trending approximately north?south. Individual faults have lengths of 3-4 km and displace middle to late Quaternary deposit, mostly, relatively rising on the west side. The northern portion of the fault zone locates along the eastern mountain front, the southern portion along the western mountain front. In spite of their complex geometries, e.g., en echelon steps and branches and so on, the Headquarters for Earthquake Research Promotion (2005) assessed that the fault zone would move as a whole during an earthquake and that magnitude would be about 7.3.

We found and observed two fault outcrops in the Kuromatsunai lowland. One outcrop which is exposing along the Babasawa River shows that the lower Pleistocene strata are thrusting over the youngest sediment (Holocene strata). The other outcrop, which is exposing at Oshamanbe Park, shows that the most mountainward reverse fault displaces the middle Pleistocene strata (it would correlate with the Chiraigawa Formation) as south-eastward incline. We also recognized similar deformations on Holocene terraces in this area.

There is at least one seismic event during Holocene time at Neppu, Warabitai, and Oshamanbe, respectively. Their timing might be at the same time. However, the active fault distribution of the Kuromatsunai teichi fault zone has complicated manner, and their late Quaternary slip rate has tendency to be small in the north area from Warabitai, and be large in the south area. Therefore the evidences of paleoseismicity which were obtained at Neppu, Warabitai, and Oshamanbe, might be correlated with the respective faulting.

Keywords: Kuromatsunai Lowland, Neppu Plain, Oshamanbe, fault outcrop, active thrust fault, paleoseismic event

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P03 Room:Convention Hall Time:May 22 18:15-19:30

Holocene environmental change in Kuji-gawa Lowland, Northeast Japan, with reference to vertical crustal movement

YAMAICHI Tsuyoshi[1*], MIYAUCHI Takahiro[2], ISHIMURA Daisuke[2]

[1]Graduate School of Frontier Sciences, University of Tokyo, [2]Graduate School of Sciences, Chiba University

There is an inconsistency that the Sanriku coast in Northeast Japan forearc has geologically uplifted and but has geodetically and seismologically subsided. In order to solve the paradox, we investigated Holocene lowland topography and geology in the mouth of Kuji-gawa of the central part of Sanirku coast and examined the Holocene vertical crustal movement, using lithofacies and diatom analysis and radiocarbon dating. The obtained results are as follows. 1) At least an emergent abrasion platform with unknown age is located at 1 m high above sea level, 2) Kuji-gawa lowland environmental chages; river mouth to bay around 10 ka, deltaic flat in 10-7.5 ka, lagoon in 7.5-7 ka and fluvial since 7 ka, 3) depicted relative sea-level curve suggests the complex history that the uplift component exceled before 7 ka and the subsidence component exceled after 7 ka, 4) The deposition and depth of the 6 ka Towada-chuseri tephra layers indicated the vertical uplift of 5 meters in late Holocene. Some of the uplift possibly results from a kind of intermittent co-earthquake movement demonstrated by the emergent coastal topography Further heightening chronological resolution relating to subtle environmental changes let us deeply understand the process and timing of such complex vertical crustal movement.

Keywords: Holocene, Sanriku coast, alluvial lowland, diatom analysis, paleoeinviroment, relative sea-level change

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P04 Room:Convention Hall Time:May 22 18:15-19:30

Surface ruptures of the Iwate-Miyagi Nairuku Earthquake: Reverse fault reactivation of caldera-collapse normal faults

Soichi Osozawa[1*], Keiji Nunohara[2]

[1]Department of Earth Sciences, Graduate School of Science, Tohoku University, [2]Tecno Hase, Co. Ltd.

The 2008 M 6.9 Iwate-Miyagi Nairuku earthquake generated a reverse-fault surface ruptures that were observed at the Ichinoseki city area included in the present excursion area, as well as the Aratozawa dam site area already reported. These faulting reactivated normal faults formed by the crustal extension by the middle Miocene opening of Japan Sea and also by the overlapped late Miocene caldera collapses.

Keywords: The 2008 M 6.9 Iwate-Miyagi Nairiku Earthquake, earthquake surface rupture, reverse fault, istric normal fault, crustal extension, caldera-collapse normal fault, reactivation

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P05 Room:Convention Hall Time:May 22 18:15-19:30

Seismic reflection survey in the Southern part of Sendai Plain

Shinsuke Okada[1*], Toshifumi Imaizumi[1], Kyoko Kagohara[2], Tomoo Echigo[3], Shigeru Toda[4], Matsubara Yoshikazu[5], atsushi Miwa[5], Yasutaka Ikeda[6], Takahiro Miyauchi[7], Daisuke Ishimura[7]

[1]International Research Institute of Disaster Science, [2]Yamaguchi University, [3]Geo-Research Institute, [4]Department of Earth Sciences, Faculty of Education, Aichi University of Education, [5]OYO Corporation, [6]Department of Earth and Planetary Science, Graduate School of Science, University of Tokyo, [7]Department of Earth Sciences, Graduate School of Science, Chiba University

Stress filed of Northeast Japan arc was drastically changed due to the 2011 Off the Pacific Coast of Tohoku Earthquake. Inland earthquakes were triggered by this drastic stress filed change. Our survey area is located on a junction Nagamachi-Rifu fault and Futaba fault, and active fault have never been distinguished clearly. In this study, we suggested concealed active fault beneath southern part of Sendai Plain, which is analyzed by air photo, 1m-DEM, and 2-DEM.

To reveal the subsurface structure of concealed active fault beneath the Sendai Plain, we carried out seismic reflection survey from January to Febuary 2013. Seismic line has a length of 5.3 km and started from Takenohana Watari town to western edge of Watari bridge via Ookuma-jinguuji. The source used in this survey was a Enviro Vib (IVI Inc.). Sweep length was 16 sec and sweep frequency range beginning at 10 Hz up to 100 Hz. The receiver was GS-20DX (natural frequency, 10 Hz; Geospace Inc.). The source and receiver spacing was 10m, with 192 ch geophones used for each recording. We selected the Geode (Geometrics) for the recording system and its sampling rate is 1 msec.

We thank Abe-haru construction company for their assistance with this seismic survey. The help of Watari town office and Sendai civil engineering office in the preparation of this survey is gratefully acknowledged. We also thank to students of Tohoku University for their assistance in our survey.

Keywords: seismic reflection survey, Nagamachi-Rifu fault, Futaba fault, concealed fault, Watari town

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P06 Room:Convention Hall Time:May 22 18:15-19:30

Quaternary underground geology and activity of the West Aizu Basin Fault Zone in the Aizu basin, Northeast Japan

Takehiko Suzuki[1*], Haruka Saito[1], Toshifumi Imaizumi[2]

[1]Tokyo Metropolitan Univ., [2]Tohoku Univ.

Aizu Basin is one of tectonic basins aligning with north-south direction in the south part of Northeast Japan. Along the west margin of the basin, the West Aizu Basin Fault Zone (WABF), an active reverse fault, stretches facing the West Aizu Basin Hills. Geomorphic development of the basin since Miocene has been discussed by Suzuki et al. (1977), Yamamoto et al. (1977) and so on. Activity of WABF during the last a few ten thousands years was reported by Fukushima Prefecture (2002). However, detailed geomorphic development of the basin and the activity of WABF in Middle Pleistocene to Holocene are not well clarified because of the lack of underground geology under the basin floor.

Kuriyama and Suzuki (2012) detected the TG Tephra (129 ka; Suzuki et al., 2004; Aoki et al., 2008) in the West Aizu Basin Hills and sediments under the basin floor, providing significant data for construction of geomorphic development and estimation of activity of WABF. Suzuki et al. (2013) reported the results of all-core boring survey (AB-12-1 core with a depth of 29 m and AB-12-2 core with a depth of 99.5 m) for the consideration on the deformation by older faulting in the basin floor. In this report, we show new identification of the tephra together with description by Suzuki et al. (2013).

AB-12-2 core

AB-12-2 core was collected at Nakaiwata (179.09 m asl), Aizu Bange Town, located 900 m east from the fault zone. This core comprises several gravel beds with depths at 48-50.46 m, 54.49-56.47 m, 76.81-84.74 m, 88.76-98.59 m, silt, peat, sands, and many tephra layers. Due to the characteristic properties (chemical composition of glass shards and refractive indices) of several tephra layers were identified as follows (depth, tephra name and age), 4.09 m: Nm-NM (5.4 ka), 17.05 m: AT (29-30 ka), 30.12 m: DKP (62 ka), 31.63 m: Nm-KN (62-65 ka), 36.82 m: Ag-OK, 45.75 m: TG (129 ka), 88.34 m: Sn-MT (180-260 ka). All are fallout-tephras except TG and Sn-MT formed as ignimbrite or lahar.

AB-12-1 core

AB-12-1 core was collected at Joguchi (177.32 m asl), Aizu Bange Town, located 2.5 km east from the fault zone. Tephra identified by chemical composition of glass shards and refractive indices from this core is only AT positioned at the depth of 14.72 m. Absence of Nm-NM identified in AB-12-2 core is explained by the difference in geomorphic surface between these sites, that is, Nm-NM at AB-12-1 was eroded with the deposition of sands and gravels of which basal level is 6.7 m in depth.

Accumulation rate of the sediments at AB-12-2 are 0.50 m/kyr between ground surface and Nm-KN, and 0.22 m/kyr between Nm-KN and TG, showing similarity to the accumulation rate estimated by Kuriyama and Suzuki (2012). Assuming that the age of Sn-MT is 220 ka, the accumulation rate between TG and Sn-MT is 0.35 m/kyr. This means no evident change in the accumulation rate between the period TG to Sn-MT and the period TG to present. If the accumulation in the basin corresponds to the activity of WABF, there is no evident change in vertical slip rate since 0.2 Ma.

This boring survey was financially supported by Grants-in-Aid for Science Research from the Ministry of Education, Science, Sports, and Culture (Research Project Number: 21240074).

Keywords: Aizu basin, tephra, active fault, Middle Pleistocene, underground geology

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P07 Room:Convention Hall Time:May 22 18:15-19:30

Subsurface structure of Fukushima Hamadori Earthquake (M7.0) .

Daiki Yokoi[1*], Shigeru Toda[1]

[1]Aichi University of Education

The earthquake occurred in Fukushima on April 11, 2011 after the Great East Japan Earthquake. Accordingly the normal fault rose along the Shionohira fault. Seismic reflection survey was carried out in order to explore the activity of the Shionohira fault.

The results are as follows; The two normal faults cross each other in the ground and the upper layer's vertical displacement the faults was bigger than lower one. The normal fault type earthquake has been occurred on this research area in the past. The fault plane bend in the crust.

Keywords: Fukushima Hamadori Earthquake, surface rupture, seismic reflection survey

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P08 Room:Convention Hall Time:May 22 18:15-19:30

Long-term uplift rate of the southernmost Boso Peninsula, northeast Japan, since the late Pleistocene

Heitaro Kaneda[1*], Naoko Kataoka[2], Shu Kawamura[3], Daisuke Ishimura[1], Takahiro Miyauchi[1]

[1]Department of Earth Sciences, Chiba University, [2]Otaki Gas, [3]Department of Earth Sciences, Chiba University

The southernmost Boso Peninsula is known as one of the fastest uplifting areas in the Japanese islands and elsewhere worldwide. The Holocene uplift rate is estimated at as high as 3 to 4 mm/yr based on raised marine terraces, but the uplift rate before the Holocene has been poorly known because of lack of Pleistocene marine terraces in and around the area. The only study that deals with Pleistocene marine terraces is Sugihara et al. (1978), in which they inferred that a well-preserved terrace surface with an altitude of ˜80 m at Ohata (Ohata surface) might be a marine terrace of MIS 5a (˜80 ka). If this is the case, the uplift rate of southernmost Boso Peninsula since the late Pleistocene is calculated at ˜1 mm/yr, which is less than one-third of the Holocene rate, requiring occurrence of some drastic event that significantly accelerated the Boso uplift after the late Pleistocene.

Our drilling on the Ohata surface and a detailed analysis of the recovered sediments reveal that the surface is undoubtedly a marine terrace, but its abandonment is most likely to have been at the earliest MIS 3 (50-60 ka). The eolian deposits beneath the Ohata surface proved to be 5.0-6.0 m thick, which is further underlain by silt and clay sediments with abrupt subunit contacts and many marine diatoms and sponge spicules. The AT tephra horizon (27-30 ka) was recognized as a clear concentration of volcanic glasses at a depth of ˜2.8 m, which allows us to estimate an age of the surface abandonment through extrapolation. On the basis of the above results, along with the sea-level change curve of Chappell et al. (1996), the uplift rate of the southernmost Boso Peninsula since the late Pleistocene is calculated at 2 to 3 mm/yr, which is now comparable to the Holocene rate. The slightly faster Holocene uplift rate may be ascribed to postglacial hydroisostatic effect. We thus conclude that the southernmost Boso Peninsula has been uplifting basically in a steady manner since the late Pleistocene, without any drastic changes in its uplift rate.

Keywords: Boso Peninsula, uplift, marine terrace, late Pleistocene

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P09 Room:Convention Hall Time:May 22 18:15-19:30

Holocene seismotectonic movement in the Uchibo coast of Boso Peninsula, central Japan, related to the Kitatake fault

Taiku Kobayashi[1*], Takahiro MIYAUCHI[1]

[1]Graduated School of Science, Chiba University

The 1703 Genroku Kanto earthquake (M8.1) and The 1923 Taisho Kanto Earthquake (M7.9) occurred along the Sagami Tough where Philippine Sea plate is subducting under the Eurasia plate, accompanying distinct coastal uplift in the Boso peninsula on the overriding plate. Referring to these crustal movements, Holocene paleoseismology has been deduced from emergent coastal topography analysis. These earthquakes are so-called Kanto earthquakes are thought to be major cause of northward tilting with uplift of the Boso Penisula. However, the coseismic movement was negative at the 1703 earthquake (Shishikura, 1999) and that lead us not to sufficiently understand the height of highest Holocene paleoshoreline (17m asl, Okada, 1995MS) only by the accumulation of coseismic uplift at 1923 type earthquake. We carefully made the recognition of Holocene highest paleoshoreline and radiocarbon-dated shell fossils sampled from emerged sea cave. Combining their results, 2m-DEM-based topographic analysis and fault modeling, we report the latest Holocene paleoseismological table and newly identified type of uplift in Uchibo coast generated by the Kitatake fault as an active fault.

(1)Around ten paleo-tidal levels are recognized in depositional and erosive emergent coastal topographies and their detailed correlation is difficult due to no continuation. Compiling radiocarbon data presented by previous study and this study, isochrones, 7 ka, 5ka and 3ka, were possibly traced.

(2)The pattern of the highest 7 ka paleoshoreline depicts the warping displacement, which is 25 m asl in Tateyama lowland, lowering to 15 m asl in Hota lowland and heightening 20 m asl in Uchibo coast again. Those of 5 ka and 3 ka paleoshorelines have the same tendency, suggesting the accumulation of displacement.

(3)The 2.2m asl abrasion bench just on the Taisho bench is recognizable only in Uchibo coast that shows the probable local tectonics which make the Uchibo coast uplift. Based on the continuity and seismic images, the Kiatake fault is causative for the local uplift.

(4)Calculating elastic dislocation putting the slip on the fault, the following parameters fit in the reconstruction of the last displacement of about 1m uplift along the coast by the movement of Kitatake fault.

Keywords: Holocene, seismotectonics, paleoseimology, Uhibo coast, Kitatake fault

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P10 Room:Convention Hall Time:May 22 18:15-19:30

Subsurface structures of Toyama basin estimated by Bouguer gravity anomaly

Toshiaki Uda[1*], Shigekazu Kusumoto[2]

[1]Graduate School of Science and Engineering for Education, University of Toyama, [2]Graduate School of Science and Engineering for Research, University of Toyama

Toyama basin is a sedimentary basin formed after the opening of the Sea of Japan in the Miocene; it has a negative Bouguer gravity anomaly because its sedimentary layer is very thick. It is known that the geological structures of this basin from the Neogene to the early Quaternary were formed essentially by tilting toward the south, and those in the late Quaternary were formed by vertical movements of a surface rectangular block having a NE-SW direction. Consequently, a compressive regional stress field having the principal stress axis in the NE-SW direction is expected in the late Quaternary.

Our ultimate aim is to restore the basic structure of the Toyama basin by numerical modeling and to quantitatively describe the formation processes of this basin and its source. However, we do not have a regional subsurface structure model of the basin. In this study, we attempted to estimate the regional subsurface structure model of the Toyama basin by using the Bouguer gravity anomaly. Here, we used the Bouguer gravity anomaly database of Komazawa (2004).

The Bouguer gravity anomalies around the Toyama basin have the following characteristics:

1) A gravity low reaching -80 mGal exists in the southeast part of the study area, which corresponds to the southern part of the Hida Mountains and Matsumoto basin.

2) Both the Tonami plain and the Toyama plain, which constitute the Toyama basin, are characterized by a gravity low, and the Noto Peninsula is characterized by a gravity high.

3) There are high gradient anomalies in the first-order horizontal derivative of the Bouguer gravity anomalies around the boundary of the Noto Peninsula and the Tonami plain. It seems that these correspond to existing active faults.

4) In addition, a high gradient anomaly of the first-order horizontal derivative of the Bouguer gravity anomalies appears around the boundary between Toyama and Niigata prefectures, and its magnitude reaches 9 mGal/km.

To obtain information on subsurface structures from the Bouguer gravity anomaly, we applied spectral analysis to the gravity anomaly in the study area; we found that the gravity anomalies in this area could be explained by a four-layers model. The average boundary depths for each layer were 10 km, 6 km and 3 km, and the wavelengths due to each layer were 16 km or more, 5-16 km and 2-5 km, respectively. From the characteristics of the long?wavelength gravity anomalies, we estimated the following characteristic subsurface structures:

i) The gravity low in the Hida Mountains is attributed to local isostasy, and the Matsumoto basin is not a deep basin; its structure does not reach the lower crust.

ii) The Itoigawa-Shizuoka tectonic line around Itoigawa, which is the northern end of this tectonic line, is not a large fault; its bottom does not reach the lower crust.

iii) The high gradient anomaly around the boundary between Toyama and Niigata prefectures is caused by a large fault, the bottom of which reaches the lower crust. We anticipated that some of the fundamental structures of Toyama basin might be formed by the activities of this large fault.

[Reference] Komazawa, M., 2004, Gravity grid database of Japan, gravity CD-ROM of Japan, ver. 2, digital geoscience map P-2, Geological Survey of Japan, AIST.

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P11 Room:Convention Hall Time:May 22 18:15-19:30

Location and activity of the Isurugi fault in the western part of the Tonami-heiya fault zone

Toshio Kamishima[1*]

[1]Graduate school of Science and Engineering for Education, University of Toyama

In the Tonami-heiya fault zone of Toyama Prefecture, there are several active faults such as Takasyozu fault in the east, Horinji fault and Isurugi fault in the west. All of them are NE-SW striking reverse fault whose degrees of activity are classified as the B-class. They have been thrusted their hanging wall in the mountain side toward the Tonami-heiya Plain. The probability of big earthquake within 30 years from the present are estimated as 0.04-6% in the east and 0-2% or more in the west(Earthquake Research Committee,2008). The Isurugi fault has been estimated as a reverse fault thrusting against hill-side in the north-west, however,Maruyama et al.(2012)estimate an activity of back thrust after the middle of the Jomon age on the basis of trench survey on the Pleistocene terraces in Fukuoka, Takaoka City.

The objective of this sutudy is to elucidate the location of the master fault of the Isurugi fault and its activity, because the range of master fault of the Isurugi fault in the plain has not hitherto been studied precisely. The author traced the fault line by comparing the stratigraphic situation of underground sediments described in the boring columnar sections of snow-melting wells dug by Toyama Prefecture and Takaoka City.

Land Condition Map of Coastal Area(1:25,000)issued from Geospatial Information Authority of Japan(GSI), precise data of altitude by air survey issued from Hokuriku Regional Development Bureau, Ministry of Land, Infrastructure and Transport, hypocenter list(1977-2001)from Kamitakara observatory, Disaster Prevention Research Institute, Kyoto University, were used in order to correlate river terraces and widespread tephra.

(1) According to the analytical result of the boring columnar sections, the depth from land surface to basement rock and the situation of sediment differ between the left bank and the right bank of the Oyabe river. This fact suggests that Isurugi fault leaves from mountain foot at Fukuoka town and runs to the north-east along the Oyabe river, extending to the northern part of Takaoka urban area.

(2) The land condition map of coastal area shows which is located in Toyama Bay off the coast of the western part of Shinminato district, Imizu City, there exists a hillock under submarine alluvium which is about 20m higher than the surrounding. This hillock is located on the north-east extension line of Isurugi fault which is estimated to run through the northern part of Takaoka urban area. Therefore, it is estimated that Isurugi fault reaches Toyama Bay at the western part of Shinminato district and runs the south side of the hillock.

(3) Isurugi fault length attains to about 30km from the southern part of Oyabe City to Toyama Bay.

(4) The seismicity map of Kamitakara observatory(2012)shows that micro-earthquake hypocenters are distributed in a range of some 15km towards the ENE direction offshore from Shinminato district, which may be related with the activity of Isurugi fault. But there remain some problems since the depths of hypocenters are not homogeneous and the distribution of hypocenter is scarce on land.

(5) The middle terrace surface of 50˜30m a.s.l. at the south-eastern foot of Mt. Futagami-yama lowers to about 15m a.s.l. at Takaoka-kojyo park to the south of Isurugi fault. DKP pumice(ca.55,oooyBP)is detected from brown-colored soils above the terrace gravel bed on both terraces. A simple calculation based on the difference of relative height showed that the degree of activity of Isurugi fault is 63˜27cm per 1,000 years.

Keywords: active fault, Tonami-heiya fault zone, Isurugi fault, boring columnar section

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P12 Room:Convention Hall Time:May 22 18:15-19:30

Seismic profiling of the offshore extension area of the Yanagase-Sekigahara Fault Zone

Yuichi Sugiyama[1*], Fumitoshi Murakami[1], Hirofumi Yamamoto[2], Takuya Usami[3], Kazuhito Hatakeyama[3], Masanori Shimazaki[3]

[1]Active Fault and Earthquake Research Center, AIST, [2]Fukui University, [3]Sogo Geophysical Exploration Co., Ltd.

We have conducted seismic reflection profiling on the offshore extension of the Yanagase-Sekigahara Fault Zone, as part of the FY 2012 MEXT survey project on active faults in the coastal zone. The survey area is about 35 km long in the N-S direction, from Matsudashi Bank about 20 km off Tojinbo, to 10 km north of the Echizen Cape.

Survey lines were located in the E-W direction at 2 to 3 km intervals along the tracks of a submarine active fault survey conducted by Japan Coast Guard in FY 2003. We carried out 16-channel seismic reflection profiling using a 200-J boomer source. The total survey track length is about 222 km.

Although the northern termination of the Yanagase-Sekigahara Fault Zone was located at the northern tip of the onshore Ayukawa Fault, the present seismic profiling has revealed an evident east-side-up active fault, 1 to 1.5 km off, and running parallel to the Echizen Coast. It has also proved that the fault connects to N-S trending faults off Fukui Port, which were revealed by Japan Coast Guard (2004) and Japan Atomic Company (2008). Further, the present profiling has made clear that the westernmost fault off the port traverses the continental shelf toward NNW and reaches to the western side of an N-S-striking anticline, which was revealed by JCG (2004) and is situated to the southeast of Matsudashi Bank.

Off the Echizen Coast the fault looks like a reverse fault because it is accompanied by a west-side-up back thrust, whereas the predominance of a strike-slip component is inferred for the NNW-striking portion off Fukui Port from lack of anticline and back thrust.

The Yanagase-Sekigahara Fault Zone extends northwards to the area where it meets with the NE-SW-trending Echizen Bank Chain. The northern termination of the fault zone inferred from the seismic profiling is about 29 km north of that by the Earthquake Research Committee (2004).

On the profile off Mera on the northern Echizen Coast, cumulative fault displacement is recognized in postglacial transgression deposits, and the displacement reaches up to the deposits after the maximum sea flooding. Therefore, it is inferred, for the offshore extension of the Yanagase-Sekigahara Fault Zone, that the most recent reactivation occurred in the past 6 thousand years (after the climax of the Jomon Transgression).

In addition, we have ascertained the existence of NNW-SSE- to NW-SE-striking normal faults on both sides of the Echizen Bank Chain, as already indicated by JCG (2004). The longest normal fault is traceable for about 11 km, and the gentlest one dips about 50 degrees on the profiles (down to 100 m in depth). Some faults show horst-and-graben structures as well as V-shaped or minor graben-like depressions of reflection surfaces, which are generally seen on strike-slip faults. The normal faults may be active even in the Holocene because their displacements reach to the sea bottom.

Keywords: Yanagase-Sekigahara Fault Zone, seismic profiling, Echizen Coast, Echizen Bank Chain, active fault, coastal area

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P13 Room:Convention Hall Time:May 22 18:15-19:30

Re-examined last fault event of the northern part of the Yanagase-Sekigahara Fault Zone along the Echizen Coast.

Hirofumi Yamamoto[1*], Yutaro Hirai[1], Yuichi Sugiyama[2]

[1]Fukui University, [2]Active Fault and Earthquake Research Center, AIST

The fault system along the Echizen Coast is considered to be one of the main active tectonic structures, which compose the northern part of the Yanagase-Sekigahara Fault Zone, central Japan. We re-examined the coseismic uplift of Echizen Coast, using topographical survey and AMS 14C ages of raised sessile organisms.

Topographical surveys show that the last upheaval of the coast was up to 7m, and the ages of sessile organisms from the lower and upper parts of the raised reef indicate that this upheaval occurred during a single faulting event.

The age of the last faulting event was re-examined, using 14C ages of raised sessile organisms which show the age before the upheaval, and the ages of the remains which show the human activities after the upheaval. These data show that the last event was in the 17th century along the southern part of the Echizen Coast, and in the period from the late 16th century to the early 17th century along the northern part. The faults along the northern and southern parts of the coast may have been activated at the same time.

Keywords: Yanagase-Sekigahara Fault Zone, Echizen Coast, paleoseismology, active fault

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P14 Room:Convention Hall Time:May 22 18:15-19:30

Geoslicer survey in submarine active fault

Toshihiko Ichihara[1*], Yoko Hirakura[2], Shimoyama Shoichi[2]

[1]Fukken Co. LTD, [2]Kyushu Univ.

In general, research submarine active faults based on geological observation, a cylindrical coring less than 10cm in diameter is performed. Geoslicer survey, which is intended to be carried out mainly on land, there is also a track record of collecting seabed geological formations. Previously was about 7m depth technical limitations. In addition, the degree 8m was also limited sample length. This time, the fault Kego Hakata Bay was surveyed the distribution is around 10m depth. Moreover, since the depth is more than 10m from the sea floor and, depending on where the acoustic basement depth up sampling length is up to 12m required degree. Depth, sample length, Geoslicer previous survey technique was both limit. So, this time, to develop a new-type-Geoslicer that can be collected at 10m depth, we conducted a survey. Geoslicer, which consists of two parts: Sample-tray and Shutter-plate, which, using steel sheet piles type III Sample-tray. Shutter-plate has produced something of 24m length. It has a structure as can be produced by assembling four parts. The structure and equipment that can also support depth change by the tide that depth collected maximum of strata is 12m, place a drainage hole removable depending on the water depth, the ever-changing during the actual survey. As a result of the formation sampling performed using the newly created Geoslicer that we were able to obtain a continuous geological samples up to 12m. In addition, we were able to collect samples of continuous formation up to 10m 10m also in depth location. Geoslicer survey sampling low orientation are possible, and you can get a large amount of sample. Coastal formations such as those targeting this is often lateral change significantly compared formation is not easy. Therefore a survey to study in a place easy to Geoslicer studied paleontological and sedimentological investigations of coastal areas shallower than 10m is very suitable.

Keywords: Geoslicer, submarine active fault, Kego fault

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P15 Room:Convention Hall Time:May 22 18:15-19:30

Subsurface geology of a tectonic bulge at Osso, central Neodani fault, based on road construction exposures

Yohei Nagarekawa[1*], Heitaro Kaneda[1]

[1]Department of Earth Sciences, Chiba University

On the up thrown side of the central Neodani fault at Osso, a terrace surface is locally deformed, forming a small tectonic bulge. We here report subsurface geology of this tectonic bulge based on exposures by the road construction (Kadowaki bypass construction) until December 2011, and examine its relation to the tectonic bulge.

We found that the tectonic bulge was formed by a simple localized uplift that has one uplift center, although the present bulge is composed of two mounds divided by an incised valley in between. The valley is thus interpreted as an antecedent valley that predates the initiation of the bulge growth and has continued to incise the bulge ever since. We also found that the deformed terrace surface is ˜40 ka based on radiocarbon ages from woods collected from the terrace deposits. On the basis of our drilling immediately behind the bulge that reveals presence of at least 4-m-think young sediment of 2 to 3 ka, a subsidiary fault is inferred along the northeastern side of the bulge in addition to the main fault on the other side.Based on a simple two-dimensional modeling assuming elastic deformation, a low-angle normal subsidiary fault is needed to reproduce the cross-sectional morphology of the tectonic bulge, although further research and analysis are necessary to examine its validity.

Keywords: tectonic bulge, active fault, tectonic geomorphology, Neodani fault

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P16 Room:Convention Hall Time:May 22 18:15-19:30

Trench Excavation Study of the Middle Itoigawa-Shizuoka Tectonic Line Active Fault System at Okaya, Central Japan

Kaoru Taniguchi[1*], Nobuhiko Sugito[2], Nobuhisa Matsuta[2], Haruhiro Maruyama[2]

[1]AFERC, GSJ/AIST, [2]Nagoya 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. Paleoseismological studies 1980s have revealed that the most recent event and the average recurrence interval of the middle ISTL. Several left-lateral active faults extend across the study area in the direction of NW-SE. Trench excavation study at Nishiyama, Okaya, revealed that the latest faulting event occurred between 3660 yBP to 4280 yBP. Details of the results will be reported in the presentation.

This study was supported by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan, under its Observation and Research Program for Prediction of Earthquakes and Volcanic Eruptions.

Keywords: active fault, paleoseismology, trench excavation study, ISTL

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P17 Room:Convention Hall Time:May 22 18:15-19:30

Timing of the last four paleoearhquake events on the Okaya fault along the ISTL active fault system, central Japan

Hisao Kondo[1*], Kaoru Taniguchi[1], Masahiro Miyawaki[2], Kouichi Sago[2], yuki masuda[2]

[1]AIST Active Fault and Earthquake Researcenter, [2]Dia consultants

We performed paleoseismic survey on the Okaya fault along the ISTL active fault system. The ISTL active fault system is well-known as one of the most hazardous fault systems based on the previously-reported paleoseismological works. In particular, the Gofukuji fault has the highest activity of the ISTL active fault system, The Okaya fault is the next fault section of the Gofukuji fault to the south, hence, the seismic potential of the Okaya fault is extremely important to estimate the size and rupture extent during the next large earthquake if the Gofukuji fault fails. The trench site is located at the base of the previously-mapped fault scarplet along the Okaya fault. The trench exposures show us clear faults cut fluvial terrace deposit and alluvium with humic back marsh deposit. Several colluvium deposits are also distinguishable over almost vertical fault planes. Judging from the relations between upward fault terminations and deposits, we identified four paleoearthquake events. All four events recorded relative subsidence forming 10-m-wide depression near the foot of fault scarplet. Additional borehole sections indicate the depth of depression is about 7 meter, and its timing of formation is after the deposition of the terrace gravel bed. The existence of depression and relative subsidence show normal faulting, but the negative flower structure and reverse faulting on some faults suggest that the Okaya fault at the site has both normal and strike-slip faulting sense. The timing is individual paleoearthquake events is still under way, but those four events occurred after the deposition of K-Ah volcanic ash that erupted in ˜7200 years B.P. The most recent event may have occurred after 1800 years. This date contradicts with the previously-reported data on the Okaya fault as well as the adjacent Chino fault. Since the largest fault segment boundary exists between the Okaya fault and the Chino fault, further refinement of the paleoseismic history and slip per event are necessary in order to improve long-term forecast of the next earthquake along the ISTL active fault system.

Keywords: active fault, paleoseismology, Itoigawa-Shizuoka Tectonic Line, historical earthquake

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P18 Room:Convention Hall Time:May 22 18:15-19:30

Vertical slip rate distribution using high-resolution digital elevation model along the Uemachi fault zone

Hisao Kondo[1*], Haruko Sekiguchi[2], Yuko Kase[1], Hidetaka Saomoto[1]

[1]Active Fault and Earthquake Research Center, Geological Survey of Japan, AIST, [2]DPRI, Kyoto University

The Uemachi fault zone is one of the major reverse fault zones extending the middle of Osaka basin, Japan. Since the fault zone is located the metropolitan Osaka City, it is important to reveal the activity of the fault and seismic potential. The Osaka Formation deposited during the Plio-Quarternary strata widely cover with the Osaka basin. The vertical slip rate of the Uemachi fault has been well determined using the Osaka Formation distributed over the fault zone. On the other hand, the slip rate at one site may have been accelerated at Ma4/6 boundary, ˜600-800 ka, from 0.1 m/ka to 0.4 m/ka. This acceleration during the Quaternary period is essential problem for the definition of active fault and the initiation of on-going fault movement. To address this issue, we revealed the vertical slip distribution along the fault zone, based on 2-m-DEM and terrace deposit. The fluvial terrace during the middle-late Quaternary period are widely distributed at the hanging wall side of the fault zone. Numerous borehole data at the footwall side, that is previously reported, provides the depth of the same horizon as the terrace deposit. These data give the accurate cumulative slip over the faults. As a result, the vertical slip rate distribution exhibits ˜0.6 m/ka along the entire fault zone, and the rate is likely constant along the strike. We further discuss the details of the cumulative slip measurement.

Keywords: active fault, slip rate, Uemachi fault zone, Quaternary, The Osaka Group

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P19 Room:Convention Hall Time:May 22 18:15-19:30

Timing of the latest faulting in the Uemachi fault zone: Pit excavation surveys at Isonokami-cho, Kishiwada City

Nobuhiko Sugito[1*], Hisao Kondo[2]

[1]Graduate School of Environmental Studies, Nagoya University, [2]Active Fault and Earthquake Research Center, Geological Survey of Japan, AIST

We have conducted tectonic-geomorphological and paleoseismological studies on the Uemachi fault zone in order to reveal timing of faulting, for estimating seismic risk of the Osaka metropolitan area. We reported paleoseismological evidence for the most recent faulting of the Uemachi fault zone. The timing of the most recent event was estimated to be after 2420 +/- 40 yBP. Coseismic uplift along the fault zone would cause dam-up of the old Yodo and Yamato River to rapidly raise water level of the old Kawachi Lake. That could account for simultaneous submergence of archaeological sites near the lake at the end of the middle Yayoi period. Based on our excavated pits at Isonokami-cho, Kishiwada City, the latest faulting event occurred between 2200-2300 yBP and the Edo era. This timing is consistent with that in our previous studies.

This research is funded by the Comprehensive Research on the Uemachi Fault Zone (FY2010-2012) by MEXT.

Keywords: Active fault, Tectonic landform, Paleoseismicity, Historical earthquake, Uemachi fault zone, Pit excavation survey

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P20 Room:Convention Hall Time:May 22 18:15-19:30

Structure and distribution of frontal fault of Uemachi Fault using borehole data

Naoko Kitada[1*], Keiji Takemura[2], Naoto Inoue[1], Hiroko ITO[1], Muneki Mitamura[3], Tomoo Echigo[1]

[1]Geo-Research Institute, [2]Kyoto University Graduate School of Science, [3]Osaka City University Graduate School of Science

In Osaka, Uemachi Fault is one of the famous active faults. It across the center of Osaka and lies in N?S direction mainly and is more than 40 km in length. Pliocene to Quaternary sediment Osaka Group and terrace sediment are found to be deposited in the Osaka Plain and Holocene marine clay layers (Ma13) are covered these plains in order to sea level change. These sediment are very thick layers over 1000m therefore, fault structure are appeared as flexure zone (only vending the strata) and hidden the fault displacement around the surface. The up side on the fault (east side) is modified by erosion and urban development however, many seismic reflection surveys information the fault trace line on a piecemeal basis. These are consisted of sand and clay deposit. Clay sediments are classified into marine and non-marine. These deposits are key layer for correlate to each other and these alternating clay layers are deposited due to glacial and interglacial cycle.

In this study, we try to estimate the width of flexure zone using geotechnical borehole database. As a result, the flexure zone is initially distributed along the spray fault (NE-SW) not along the main fault. It indicates that spray fault might be the primary frontal fault in the present. In order to study, we use borehole database called GI-base of KG-Net. KG-Net borehole database has more than 20,000 borehole data around Osaka. At first, we examined the borehole data along the seismic reflection line. And then consider the surrounded area. As a result, folding zone is distributed in the west side of Osaka area.

Acknowledgment,This research is funded by the integrated research project for the Uemachi active fault system in FY2011 by MEXT.

Keywords: borehole, folding, Osaka Group, Sedimentary environment, sea level change, active fault

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P21 Room:Convention Hall Time:May 22 18:15-19:30

Characteristics of Subsurface flexure of Uemachi Fault in the Osaka City area

Keiji Takemura[1*], Naoko Kitada[2], Naoto Inoue[2], Hiroko ITO[2], Muneki Mitamura[3], Tomoo Echigo[2]

[1]Kyoto University Graduate School of Science, [2]Geo-Resarch Institute, [3]Osaka City University Graduate School of Science

In Osaka, Uemachi Fault is one of the famous active faults. It is across the center of Osaka plain. Generally, Uemachi fault is located in N?S direction mainly along the Uemachi uphill in the main area of Osaka City. Pliocene to Quaternary sediment Osaka Group and terrace sediment are found to be deposited in the Osaka Plain and Holocene marine clay layers (Ma13) are covered these plains in order to sea level change. Kitada et al (2012) recognized the parallel frontal fault in the western Osaka using borehole data. In this study, geological borehole sampling was carried out in the two areas. UMH22-1 is for Sakuragawa flexure zone and UMH23-1,2 are for the Suminoe flexure brock. We found many tephra layers and correlate the Ma numbers. These top marine clay sediment are decided using 14C dating. The result of this analysis, activity rate of frontal fault is larger than the main existing fault.

In this poster, we would like to show the detail of these studies.

Acknowledgment:This research is funded by the integrated research project for the Uemachi active fault system in FY2011 by MEXT.

Keywords: borehole, deformation, Osaka Group, sedimentary environment, sea level change, tephra

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P22 Room:Convention Hall Time:May 22 18:15-19:30

Basement configuration of Osaka basin based on dislocation model by Uemachi and surrounding faults

Naoto Inoue[1*], Naoko Kitada[1], Keiji Takemura[2]

[1]Geo-Research Institute, [2]Institute for Geothermal Sciences, Kyoto University

The N-S trending 42-km-long Uemachi faults traverse in the central part of the Osaka city. The Uemachi faults have been investigated for countermeasures against earthquake disaster. The Ministry of Education, Culture, Sports, Science and Technology started the project to survey of the Uemachi faults. The Disaster Prevention Institute of Kyoto University is carried out various surveys from 2009 to 2012 for 3 years. Kusumoto et al. (2001) reported that surrounding faults enable to form the similar basement relief without the Uemachi faults model based on a dislocation model. We performed various parameter studies for dislocation model, which were designed based on the distribution of the real faults. The model was consisted 11 faults, the Rokko-Awaji, ATL, MTL, Ikoma, Eastern Nara, Osaka-wan, Kongo, the North and South Uemachi faults and, Sakuragawa and Suminoe flextures. The dislocation was calculated based on the Okada et al. (1985). The results show the similar basement displacement pattern to the actual basement configuration.

This research is funded by the Comprehensive Research on the Uemachi Fault Zone (in FY2012) by MEXT.

Keywords: Osaka Basion, Uemachi fault, dislocation model

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P23 Room:Convention Hall Time:May 22 18:15-19:30

A Gravity Survey in the Middle Southern Part of Osaka Bay Area

Kunihiro Ryoki[1*], Tadashi Nishitani[2]

[1]Hyogo Polytechnic Center, [2]Akita University

1. Introduction

When it is shown that the gravity anomaly map in and around Osaka Plain, for example, Nakagawa *et al.* (1991), a small rise of the gravity anomaly exists characteristically in the middle southern part of Osaka Bay Area. Distribution of the gravity anomaly is suggested the presence of faults along the bay area. But it is not deny that a dome-shaped subsurface structure exists there. Accordingly, the gravity anomalies have been measured in a high density on the survey line across the small rise in order to obtain some information about its structure.

2. Study Area

Gravity measurement was carried out in two survey lines, AA' and BB'. Line AA' lay along Prefectural Road 40, where was called Kishiwada Chuo Line, between point A as the bay front and A' as the vicinity of Imaki-cho in the northern part of Kishiwada. Line BB' was set up along Prefectural Road 38 and 225 between point B in Shiomi-cho, where coastal Izumiotsu, and B' nearby Izumi Fuchu Station, where southwestern part of Izumi City. The length of the former was approximately 5 km and the latter was approximately 4 km. The measurements were mainly performed on the benchmarks of urban area. Interval of each station was approximately 50 m. Elevation values of the benchmarks were introduced for gravity correction.

3. Measuring Method

The measurement was carried out with G-308 gravimeter manufactured by LaCoste & Romberg. A temporary reference station of the gravity had been installed on Kinki Polytechnic College in Inaba-cho, Kishiwada. The gravity value was determined by comparing at the first class gravity station in Wakayama Local Meteorological Observatory (Ryoki and Nishitani, 2010). In addition, it was also compared with Kyoto FGS in Kyoto University (Ryoki, 2012). On this point, the daily measurement was made the closed loop.

4. Results and Discussion

Results of the measurement are shown higher values in northwest side (sea side) and lower in southeast side (mountain side) along Line AA' or Line BB'. These results suggest a fault structure. The southern part of Uemachi Fault Zone is positioned on the southeast side of the survey lines extension of both. Gravity anomalies in which, on the contrary, are lower values in the northwest side and higher in southeast side (Ryoki and Nishitani (2010), Ryoki and Nishitani (2011)). Ikeda *et al.* (2002) showed that Sennan Active Segment exists between them. However, it is not clear from the results of gravity. Therefore, in the studies of authors, it is suggested that the structure of conjugate fault system along the Bay Area exists with Uemachi Fault Zone.

5. Conclusion

Distribution of the gravity value was obtained in high density equivalent survey line to cross the fine high-gravity area that existed in the middle southern Osaka Bay Area by this study. These distributions suggest to run a reverse fault structure. Future expected to be integrated with the previous measurements, the three-dimensional structure may be to analyze.

References

Ikeda, Y., T. Imaizumi, H. Sato, M. Togo, K. Hirakawa, and T. Miyauchi (Eds.) (2002); *Atlas of Quaternary Thrust Faults in Japan* (in Japanese), University. of Tokyo Press, Tokyo., p.p. 254.

Nakagawa, K., Ryoki, K., Muto, N., Nishimura, S. and Ito, K. (1991): Gravity Anomaly Map and Inferred Basement Structure in Osaka Plain, Central Kinki , South-west Japan, *Journal of Geoscience*, Faculty of Science, Osaka City University, vol. 34, p. 103 - 117.

Ryoki, K., Nishitani, T. (2010): A Gravity Survey in the Southernmost Area of Uemachi Fault Zone, *Abstract of JGUM 2010*, SSS015 - P16.

Ryoki, K., Nishitani, T. (2011): A Gravity Survey in the Southern Area of Uemachi Fault Zone, *Abstract of JGUM 2011*, SSS034 - P18.

Ryoki, K. (2012): A Gravity Measurement at the Reference Station of Osaka City University and its Variation, *Abstract of JGUM 2012*, SGD24 - P07.

SSS32-P23 Room:Convention Hall Time:May 22 18:15-19:30

Keywords: gravity anomaly, reverse fault, Sennan Active Segment, Uemachi Fault Zone, 3D structure analysis, high dense gravity measurement

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P24 Room:Convention Hall Time:May 22 18:15-19:30

Comprehensive research on the Uemachi fault zone (3)

Tomotaka Iwata[1*], Comprehensive Research Group on the Uemachi Fault Zone[2]

[1]DPRI, Kyoto University, [2]Comprehensive Research Group on the Uemachi Fault Zone

The Uemachi fault is running beneath the Osaka sedimentary basin, which is the secondary large populated area in Japan. Our research group has started to study the Uemachi fault zone in detail to get the information for developing the long-term evaluation of earthquake occurence and the strong ground motion prediction as the integrated research project for the Uemachi active fault system by MEXT for FY2010-2012. Our research group consists of four sub-research groups for (1) research on detail trace for fault segments, (2) research on three-dimensional source fault and crustal velocity structure, (3) research on fault activity and average dislocation velocity, and (4) research on strong ground motion prediction. Here we will summarize research results in this project.

Keywords: Uemachi fault zone, active fault survey, long-term evaluation, strong ground motion evaluation

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P25 Room:Convention Hall Time:May 22 18:15-19:30

Off shore active fault survey ”Nunobiki sanchi eastern Fault group”. Result of high resolution geostratigraphic survey.

Masatoshi Yagi[1*], Izumi Sakamoto[2], Yuka Yokoyama[2], yoshiyuki takino[2], FURUHATA, Takuma[2], HARADA, Yoshinobu[2], NEMOTO, Kenji[2], FUJIMAKI, Mikio[4], Yukinobu Okamura[3]

[1]Graduate school, Tokai University, [2]School of Marine Science and Technology, Tokai University, [3]Active Fault and Earthquake Research Center, [4]Coastal ocean research,Co.

Tokai University performed high-resolution geostratigraphic survey to confirm a formation, distribution, and displacement around the coastal area of the Nunobiki sanchi eastern margin fault group around the Ise bay in 2012.

Results: In the Northern area (offshore of Suzuka city), the fault has confirmed which has not displaced new sediments. And, a number of Folds have confirmed in acoustic basement.

In the middle area (offshore of Shirako), the E-W trending spur has developed. The fault confirmed of the E-W direction on the south side of the spur. It was as harmonic as existing Shirako-Noma fault. This fault has not displaced new sediments, either. The flower structure which indicate the lateral fault confirmed on the north side of the spur.

In the southern area (offshore of Tsu city), a terrace with a gentle slope observed under the thick sediment. Also, confirmed new small scale (displacement: 0.7m˜1.4m) faults (NF-6˜9) which slip down new sediments (indicate about before ten thousand year).

Some active faults were observed at the southern area. And Shirako-Noma fault also has a strike-slip component was estimated.

Keywords: Active Faults, Ise Bay, Strike-slip faults, Flower structure

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P26 Room:Convention Hall Time:May 22 18:15-19:30

Internal structures of the fault gouge zones along the Ikoma active fault zone

Keisuke Mitamura[1*], OKUDAIRA, Takamoto[1], MITAMURA, Muneki[1]

[1]Graduate School of Science, Osaka City University

The NNE-SSW-N-S trending Ikoma active fault zone is recognized as a high-angle reverse fault under the E-W compressional stress field in the Quaternary Japan. However, from the rock mechanics point of view, high-angle fault is favorable as normal fault formed under extensional stress regime. The high-angle reverse faults may be resulted from the reactivation of the high-angle normal faults (inversion tectonics). In this study, we examined some fault gouge zones along the Ikoma fault zone (Katano and Ikoma faults).

We found two fresh outcrops of mesoscopic fault zones developed along the Ikoma fault zone at Kuraji of Katano City and Kiyotaki of Shijonawate City. In these fault zones, fault gouge wit the width of 20-30 cm can be observed. We collected some oriented samples and made thin sections parallel to the striation and normal to the fault plane. In the samples, many dark seams develop parallel to the main fault plane (striation) to form a distinct foliation within the fault gouges. Many fragments with various sizes are observed and their long axis aligned oblique to the fault plane. The parts where edges of the fragments meet the dark seam the edges tends to be rounded, suggesting that the formation of the dark seam was associated with material transportation due to pressure solution. The fragments with high aspect ratios tend to align oblique to the fault plane, suggesting the rigid-body rotation caused by non-coaxial shear deformation. The asymmetric structures, i.e., preferential orientation of the long axis of fragments, drag folds and shear lenses indicate the top-down-sense-of-shear. Furthermore, fractal dimensions of the fragments in samples near the main fault plane are higher than in samples at the margin of the fault gouge.

Consequently, we found the lines of evidence indicative of normal fault movement in the fault gouges associated with the Ikoma active fault zone, suggesting that the N-S striking Ikoma fault zone is recognized as a high-angle reverse fault under the E-W compressional stress regime are of reactivation of the preexisting high-angle normal faults that may be formed under extensional stress field.

Keywords: Ikoma fault zone, deformation structures, fracture zone, fault gouge, fragments, active fault

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P27 Room:Convention Hall Time:May 22 18:15-19:30

Holocene Faulting History of the Kawakami Fault of the Median Tectonic Line Active Fault Zone in northwest Shikoku, Sout

Michiharu Ikeda[1*], Hiroyuki Tsutsumi[2], Hideaki Goto[3], Naoki Nishizaka[4], Yuki Ohno[4], makoto yanagida[5], Shuji Kobayashi[1]

[1]Shikoku Research Institute Inc., [2]Kyoto University, [3]Hiroshima University, [4]Shikoku Electoric Power Co. Inc., [5]Hanshin Consultantsu Co. Ltd.

Several long, active strike slip fault systems that produce cascade earthquakes have been observed to rupture over only part of their total length during large earthquakes. The faulting history of each segment is one of the important data to evaluate the relationship among neighboring segments. The detail faulting history of a fault segment needs to be considered by the contrasting fault event data obtained in several survey sites along the fault segment. However, the faulting history of some fault segments including the Kawakami Fault which are the parts of the Median Tectonic Line active fault zone is evaluated based on just one survey point data, however many surveys have been conducted since 1980.

We conducted a trench survey of the Kawakami Fault at the Ususaka in the Saijyo-city to obtain the faulting history data. The faulting history of the Kawakami Fault is evaluated on the basis of a trench survey at the Himi in the Saijyo-city (Tsutsumi et al., 2000). Tsutsumi et al. (2000) reported that the Kawakami Fault have occurred three faulting events in about 4000 years. The latest faulting event age is estimated to be from Asuka to Edo era, and contrasted with 1596 Keicho earthquake in historical document data.

This trench survey results revealed that the Kawakami Fault have occurred three faulting events in about 6000 years. The latest faulting event occurred after 525 cal. y.B.P. Other events occurred between 1885 and 4240 cal.y.B.P., and before 3895 cal.y.B.P. These data coincide with the fault event data reported by Tsutsumi et al. (2000). The faulting history of the Kawakami Fault based on both data is summarized as following. The latest faulting event occurred between 525 and 172 cal. y.B.P., and the penultimate event occurred between 950 B.C. and 1925 cal. y.B.P. Other events occurred between 1885 and 4240 cal.y.B.P. and before 3895 cal.y.B.P. Given that the 1596 Keicho earthquake is the latest faulting event of the Kawakami Fault, the average recurrence intervals are 1943 years in the longest and 765 years in the shortest.

Keywords: Median Tectonic Line Active Fault Zone, Kawakami Fault, Trench survey

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P28 Room:Convention Hall Time:May 22 18:15-19:30

Tectonic geomorphology along the Oharako fault zone: an example of a long active fault in western Chugoku region, Japan

Masayoshi Tajikara[1*], Hiroyuki Tsutsumi[3], Takashi Nakata[2], Hideaki Goto[2], Takashi AZUMA[4], Tokihiko Matsuda[1], Tadaki Mizumoto[1], Ritsuko S. Matsu'ura[1]

[1]ADEP, [2]Hiroshima Univ., [3]Kyoto Univ., [4]AFERC, AIST

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 analysis during the last two 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 Oharako Fault Zone 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, fault scarplet on fluvial terrace) are newly mapped. As a result, we clarified that the Oharako Fault Zone is an active fault system with 60 km in length, and that the Oharako Fault Zone have a capability of causing M7.8 earthquake.

Keywords: Oharako fault zone, active fault, western Chugoku region, inland earthquake, air photo interpretation

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P29 Room:Convention Hall Time:May 22 18:15-19:30

Estimation of the activity events of the Kego Fault Zone based on the sedimentary ages in Geo Slicer cores in Hakata Bay

Yoko Hirakura[1*], Shoichi SHIMOYAMA[2], Toshihiko ICHIHARA[3], Keitaro YAMADA[4]

[1]Department of Earth and Planetary Sciences, Faculty of Sciences, Kyushu University, [2]Department of Earth and Planetary Sciences, Faculty of Sciences, Kyushu University, [3]Division of Ground Survey, Fukken Co., Ltd., [4]Division of Earth and Planetary Sciences, Graduate School of Science, Kyoto University

Introduction

The Kego Fault Zone, passes through Fukuoka city area, is active fault. Its extension reaches to the sea area. A part of the extension has been reported by Okamura et al (2009), but it is different from the Kego Fault seen in land area in a characteristic. Therefore submarine active fault investigation in Hakata Bay was carried out to clarify the character of the Kego Fault Zone in the sea area this time.

Method

Submarine acoustic survey was carried out to determine location of active faults. Location of active faults was pinpointed by a result of acoustic survey and by precedent studies. A geo-slicer survey was carried out in two spots (HKA1 and HKA2 sites) where it was thought that data connected with the fault activity were easy to be provided by stratum collection.

As a result of geo-slicer survey, 3 sedimentary cores at HKA1 site and 4 sedimentary cores at HKA2 site, of approximately 8-10m in length were obtained. In addition, volcanic glass content in sedimentary sample was found, and refractive index was measured.

Shape of faults based on the submarine acoustic survey

As a result of the submarine acoustic survey, in HKA2 site, the east side subsidence in the fault was recognized like the Kego Fault of the inland area and Okamura et al (2009). On the other hand, in HKA1 site located on the east side from HKA2, the west side subsidence in the fault was recognized. In other words a graben structure is confirmed. For both sites, the displacement of the stratum of the acoustic basement is clear (depth 8 m). It is very likely that a multiple activity history of the faults was recorded at these sites.

Age-estimation of the sedimentary cores and the latest fault activity event

Contents of the volcanic glass collected from every 20cm depth interval in the sedimentary cores were examined. This refraction indexes of glass and the results of radiocarbon date of sedimentary core indicated that it is the K-Ah tephra origin. The peak of the volcanic glass content is the key bed of the K-Ah as the ash falling event (ca. 7,300 cal. yBP). Based on the results of radiocarbon dating and volcanic glass examination, after acoustic basement (about 8,900 yBP), fault activity events were recognized two times at least at HKA1 site, although only one time at HKA2 site. The latest activity event of the former is about 4,200 to 4,800 yBP, however the latter one is about 8,000 to 8,300 yBP. Therefore, two faults in the Kego Fault Zone are remarkably different in activity.

Keywords: Kego Fault Zone, Hakata Bay, acoustic sections, Geo-Slicer survey, K-Ah tephra fall event, latest activity event

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P30 Room:Convention Hall Time:May 22 18:15-19:30

The distribution and timing of recent activity in the Kego Fault Zone in Hakata Bay, West Japan

Shimoyama Shoichi[1*], Nozomi ISO[2], Takahito KUROKI[3], Makoto OKAMURA[4], Toshihiko ICHIHARA[5], Yoko HIRAKURA[6], Naoko KITADA[7]

[1]Department of Earth and Planetary Sciences, Graduate School of Science, Kyushu University, [2]Department of Child Education, Faculty of Human Sciences, Sainangakuin University, [3]Division of Social Studies Education, Fukuoka University of Education, [4]Department of Earth Sciences, Faculty of Science, Kochi University, [5]Fukken Co., Ltd., [6]Department of Earth and Planetary Sciences, Faculty of Sciences, Kyushu University, [7]Division of Earth Sciences, Geo-Research Institute

The Kego Fault Zone is divided into two segments, northwest and southeast. The sources of the Fukuoka Prefecture Western Offshore Earthquakes of 20th March, 2005 were in north-western segment. The southeastern part (the Kego Fault in the narrow sense) is an extension of the north-western segment but was not active at that time. It is important to understand the outcrop position and activity history of the Kego Fault in detail because it passes beneath densely-populated areas in the Fukuoka Plain. For this reason, trenching surveys were carried out at Osano, Dazaifu City (Fukuoka Prefecture Office, 1996), at Yakuin, Fukuoka City (Fukuoka City Office, 2001), at Kamioori, Onojo City (Miyashita et al., 2007), at the Hamanomachi Park, Chuo-Ku, Fukuoka City (Fukuoka City Office, 2009), and a piston-coring survey was made in Hakata Bay (Okamura et al., 2009). The results indicate that the recent activity and the intervals between the activities on the Kego Fault were different at the sites surveyed. In particular, the most recent activity at the piston-coring site in Hakata Bay was c. 4,000 yBP whilst that at the trenching site in Hamanomachi Park was c. 8,000 yBP, even though the two sites are only 5.5 kilometers apart.

The purpose of this study was to determine the ages and locations of recent seismic events along the Kego Fault Zone in Hakata Bay. The survey was commissioned by the Ministry of Education, Culture, Sports, Science and Technology in Japan.

A submarine acoustic survey was carried out to determine the locations of the most recently activity parts of the active fault zone, and Geoslicer cores were obtained to determine the ages of the most recently seismic events of the faults. This sedimentology of the cores was described, and radiocarbon dating and volcanic-glass analyses were carried out. The acoustic survey provided numerous sections that enabled four principal acoustic- reflection layers to be identified in the near-surface sediments. These were labeled, in ascending order, A, B, C, and D in accordance with Okamura et al., 2009. Two patterns of fault-induced deformation were recognized in the acoustic profiles. In the first, in the northern part of the Hakata Bay, the B layer and the underlying beds were deformed. In the second, in the southern part of the bay, the C layer and the underlying beds were deformed. These patterns indicate a geographically unevenly distributed activity along the fault zone. A graben structure that consists of several faults is present in the central part of Hakata Bay.

Three or four 30 cm-wide sediment cores 8 to 10 m long were obtained using the Geoslicer along three transects of the faults. The cores and the acoustic sections were correlated, and the depositional ages of the sediments determined on the basis of their depth below sea bed correlated with the radiocarbon dates (revised for calendar years).

Two phases of fault activity were recognized during the Holocene at site HKA1 (at 2.2 to 2.7m below sea bed and 5.9 to 6.4m below sea bed), and only one at site HKA2 (at 5.9 into 6.8 m below sea bed). These events have been dated to c. 4,200 to 4,800 yBP and c. 8,000 to 8,300 yBP.

It is concluded from this study that the northwestern and southeastern faults within the Kego Fault Zone form a graben in the central part of Hakata Bay, and that the two parts have different recent activity histories. They were simultaneously active once in every two activity events.

Keywords: Kego Fault Zone, Hakata Bay, acoustic sections, Geo-Slicer core, latest activity event, segment boundary

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P31 Room:Convention Hall Time:May 22 18:15-19:30

Characteristics of normal faults in coastal area: case study in the Kawaminami Fault, southern Kyusyu

IKUTA, Masafumi[1], Masakazu Niwa[1*], TAKATORI, Ryoichi[1], KUROSAWA, Hideki[2], KOSAKA, Hideki[3]

[1]Japan Atomic Energy Agency, [2]OYO corporation, [3]Kankyo-Chishitsu Co., Ltd.

The 2011 off the Pacific coast of Tohoku Earthquake has been triggering a large amount of earthquake, including the April 11, 2011 Fukushima-ken Hamadori earthquake. The normal faults (Itozawa and Yunodake Faults) were ruptured during the earthquake (Tsutsumi and Toda, 2012). Although there are several normal faults in coastal area on the Pacific side, such type of normal faulting (triggered by a large earthquake in plate convergence) has never been reported until the earthquake in Fukushima. Therefore more case studies focused on normal faults are needed to assess the risk of fault activity in coastal areas. As such case study, we are doing geological and topographical surveys in the Kawaminami Fault, lying along the northern margin of the Miyazaki Plain.

Several studies suggest the Kawaminami Fault is a normal fault showing uplift of the western side, displacing a higher terrace (e.g. The Research Group for Active Tectonics in Kyusyu, 1989). However, there are no detailed studies in and around the fault, though Quaternary geologic and topographic evolution of the Miyazaki Plain has been summarized (e.g. Nagaoka et al., 2010). In this study, first, we focused on the spatial distribution and characteristics of the higher terrace. In the western side of the Kawaminami Fault, terrace deposits characterized by red soil matrix are scattered at an altitude ranging 200 to 250 m. the deposits mainly include hard, well-rounded gravels of chert and sandstone derived from the Shimanto accretionary complex, and pebbles to boulders of welded tuff (some of them are thoroughly weathered) of Osuzuyama Volcano-plutonic Complex. We newly discovered successive exposures of other deposits characterized by red soil matrix at an altitude of approximately 100 m along the Kawaminami Fault. We will try to reconstruct the spatial distribution of these deposits and their relationship with the activity of the Kawaminami Fault. In addition, several lineaments and tilted landforms are identified in the plain area, eastern side of the fault. We also focus on the probability of the seaward migration of the fault activity.

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P32 Room:Convention Hall Time:May 22 18:15-19:30

Continuity between the Hinatatoge-Okasagitoge Fault and the Itoshima-hanto-oki Fault Group, West Japan

Shoichi Shimoyama[1], Tomoki Tsuji[2*], Nozomi Iso[3], Takahito Kuroki[4], Toshihiko Ichihara[5], Keita Takada[5]

[1]Department of Earth and Planetary Sciences, Graduate School of Science, Kyushu University, [2]Formerly: Department of Earth and Planetary Sciences, Faculty of Sciences, Kyushu University, [3]Department of Childhood Education, Faculty of Human Sciences, Seinan Gakuin University, [4]Department of Social Studies Education, Fukuoka University of Education, [5]Fukken Co., Ltd.

Research in recent years has identified three active faults over almost straight line between the Itoshima Peninsula offing in Fukuoka Prefecture and Tosu City in Saga Prefecture. The Itoshima-hanto-oki Fault Group and the Maebaru Fault were first recorded by the Kyushu Electric Power Company Inc. (2009) and the Hinatatoge-Okasagitoge Fault by the Research Group for Active Fault Geometry and Segmentation (unpublished). The possible continuity of three faults was not investigated because these faults were found by different organizations, and the Hinatatoge -Okasagitoge Fault was not investigated in the field.

The present study had two aims. First, to research the topography and geology of the Hinatatoge-Okasagitoge Fault and the Maebaru Fault in order to clarify their locations and activities. Second, a drilling programme was carried out to investigate the possible continuity of the three faults.

The results were as follows. An analysis of air photographs proved sinistral displacements of a valley and a mountain ridge, the presence of a low fault scarp, and the outcrops of the Hinatatoge- Okasagitoge Fault. Additional detailed research was carried out in the following three districts.

1) Wakiyama district, Sawara Ward, Fukuoka City

A low fault scarp (3.5 m high) was recorded on the Lower Terrace 1. The formation age of the terrace is presumed to be approximately 85 ka. It is, therefore, indicating that the average vertical slip rate on the fault is estimated 4 cm/ka (Activity Rank, Class C).

2) Maebaru district, Itoshima City

A linear topographical feature was recorded at Maebaru between the Hinatatoge-Okasagitoge Fault and the Maebaru Fault. Borehole records show that there is a 6.6 m high displacement of the top of the granitic basement beneath this feature. A borehole core proved a fault in the granitic rocks and an 0.57 m displacement of the base of the middle terrace deposits. There is, therefore, an active fault in this district.

3) Shinowara district, Itoshima City

Borehole cores drilled for an expressway proved a 7.22m high displacement of the top of the granitic basement. This confirms the presence of an active fault in this district.

The principal conclusions of this study are:

1) The detailed study of the topography and field geology has defined the position of the Hinatatoge-Okasagitoge Fault.

2) Previously unknown faults were recorded in the area between the Maebaru and Shinowara districts at Itoshima City, midway between the Hinatatoge-Okasagitoge Fault and the Maebaru Fault.

3) The Itoshima-hanto-oki Fault Group, the Maebaru Fault and the Hinatatoge-Okasagitoge Fault form part of a single fault zone with a combined length of approximately 51 km (M=7.7).

4) The average vertical slip rate on the Hinatatoge-Okasagitoge Fault in the Wakiyama district, Sawara Ward, Fukuoka City, is estimated to be 4 cm/ka (Activity Rank, C Class).

Keywords: Hinatatoge-Okasagitoge Fault, Itoshima-hanto-oki Fault Group, Maebaru Fault, borehole cores, combined length, average slip rate

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS32-P33 Room:Convention Hall Time:May 22 18:15-19:30

Aseismic creeping of the Philippine fault in Leyte Island, Philippines, revealed by field observation and InSAR analysis

Hiroyuki Tsutsumi[1*], Yo Fukushima[2], Jeffrey S. Perez[3], James J. Lienkaemper[4]

[1]Department of Geophysics, Kyoto University, [2]Disaster Prevention Research Institute, Kyoto University, [3]Philippine Institute of Volcanology and Seismology, [4]US Geological Survey

The Philippine fault is a 1250-km-long, left-lateral strike-slip fault extending NNW parallel to the Philippine archipelago. This fault has been very active in the past 100 years with several destructive earthquakes accompanied by surface rupture in Luzon and Mindanao Islands. We identified evidence for aseismic creeping of the Philippine fault in Leyte Island located on the central portion of the fault. InSAR analyses of the satellite images taken between February 2007 and January 2011 also revealed a sharp contrast in the displacement fields across the fault trace that suggests aseismic creeping of the fault. In the field, we are able to identify left-lateral offsets of artificial features with known construction years in northern and central island, giving slip rates as much as 24mm/yr, which is comparable to the GPS-derived slip rate of the fault in Masbate Island. In order to precisely estimate the creep rates, we initiated alignment array measurements of the creeping section of the Philippine fault, similar to the one conducted along the Hayward fault in the San Francisco Bay area.

Keywords: Philippine fault, Leyte Island, creeping, InSAR analysis, alignment array measurement