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

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

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

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

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

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

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

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