Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

HDS029-P01 Room:Convention Hall Time:May 25 16:15-18:45

Offshore active fault survey ”Futagawa-Hinagu Fault Zone”(1) Results of the High-resolution Multi-Channel Sonic survey

Kyoko Kagohara[1*], Takanobu Aiko[4], Ikuhisa Adachi[4], Izumi Sakamoto[3], Yoshiyuki Takino[3], Naoto Inoue[2], Naoko Kitada[2], Fumitoshi Murakami[1], Yukinobu Okamura[1]

[1]AFERC, AIST, [2]GRI, [3]Tokai Univ., [4]Daiwa Exploration & Consulting. co. ltd.

The 100-km-long Futagawa-Hinagu Fault zone is extending from piedmont of the Aso volcano to the Yatsushiro sea. The south-western extent of fault zone, composed by many NE-SW trending faults in the Yatsushiro sea bottom. We have conducted high-resolution shallow sonic survey using boomer source and 24-channel, 3.125-m-channel-interval streamer to clarify the precise fault-trace distribution, fault deformation features and displacement of the fault group in Yatsushiro sea. The acoustic profiles imaged several steep faults and the related narrow graben and folds.

Keywords: Futagawa-Hinagu Fault Zone, Offshore, active fault, strike-slip fault, Yatsushiro-sea

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Offshore active fault survey ”Futagawa-Hinagu fault group”(2) Result of high resolution geostratigraphic survey

Izumi Sakamoto[1*], Kenji Nemoto[1], Ryosuke Hirayama[1], Koya Sano[1], Yuka Sekine[1], Kouhei Saita[1], Yoshiyuki Takino[1], Mikio Fujimaki[2], Naoto Inoue[3], Naoko Kitada[3], Kyoko Kagohara[4]

[1]Dept. Marine Mineral Res., Tokai Uni., [2]Coastal Ocean Research, Co., [3]Geo Research Institute, [4]Geological Survey of Japan

Tokai University performed high-resolution geostratigraphic survey to confirm a formation, distribution, and displacement around the coastal area of the Ftagawa-Hinagu fault group. We use a parametric acoustic system that has 1) nallow beam with, 2) wide secondary frequencies, 3) high pulse repetition rate, and 4) high resolution technical characters.

The investigation sea area is located central part of Yatsushiro Sea. The Ftagawa-Hinagu fault presents the structure of the NE-SW direction in this area. We arranged parallelism and line of perpendicular 500m distances in the dislocation as reconnaissance survey. And we also arranged 25 to 50m-grid line for detailed survey. Total line reached 255km.

Acoustic stratigraphical character: We divided into 4 acoustic stratigraphical layer (L-1, L-2, L-3, and L-4) by the character of reflective surface and reflective formation. L-4 layer is an acoustic basement of this study area, and the top surface is characterized with a reflector full of unevenness. L-3 layer presents a clear reflection pattern in no layered bedding, and the top surface is a comparatively flush reflector. L-2 show excels of horizontally inside reflection and the top surface contacts unconformable relationship with the overlying L-1 layer. L-1 with no layered bedding exist the most upper part of this area.

Results: In the A area (which locates northern end of study area), the main fault develops on a straight line in succession in the NE - SW direction, but changes into a fault zone with graven structure in the northern end part. The drag fold structure (passed to 1,000m) was confirmed with the transcurrent fault, and also confirmed the dip of fold structure becomes gentle toward the northeast side.

The acoustic scattering layer was observed around the northeast part of study area. In this area, the acoustic scattering layer develops toward the northeast along the fault. It seems that we are connected with a development of acoustic scattering layer and a tomographic development.

As the detailed offshore high-resolution geostratigraphic survey with short wide grid line, some transcurrent faults structure such as drag fold structure and flower structure was successfully observed.

Keywords: Futagawa-Hinagu fault group, high resolution geostratigraphic survey, drag fold structure, acoustic scattering layer

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Offshore active fault survey ”Futagawa-Hinagu Fault Zone”(3) Result of piston-core sampling

Naoto Inoue[1*], Naoko Kitada[1], Tomoo Echigo[1], Takahiro Kubo[5], Akira Hayashida[2], Izumi Sakamoto[3], Kyoko Kagohara[4]

[1]Geo-Research Institute, [2]Doshisha University, [3]Tokai University, [4]Advanced Industrial Science and Tech., [5]Kawasaki Geological Engineering Co.,Ltd.

The Futagawa-Hinagu Fault Zone, traversing the Yatsushiro Sea in the NE-SW direction, extends from Mt. Aso to the Yatsushiro Sea. The offshore zones of the fault zone lack reliable information on termination of fault-trace, activity and faulting history. We have carried out a paleoseismological piston coring, as a part of the 2010 offshore active fault survey project funded by MEXT. The purpose of the investigation is to clarify the faulting history and activity (average slip rate) of the offshore fault zone.

The offshore fault zone of the Futagawa-Hinagu Fault Zone indicates the small-scale graben structure.

We decided the following 7 sites for piston coring, based on the results of high-resolution multichannel and ultra-high-resolution single-channel sonic surveys. We got the following 7 cores in the Yatsushiro Sea.

HG-1 (Core length : 6.52m)
Latitude / Longitude (WGS84) = 32:18:50 / 130:24:29
HG-2 (Core length : 6.75m)
Latitude / Longitude (WGS84) = 32:18:46 / 130:24:32
HG-3 (Core length : 2.59m)
Latitude / Longitude (WGS84) = 32:18:21 / 130:24:49
HG-4-2 (Core length : 1.96m)
Latitude / Longitude (WGS84) = 32:18:16 / 130:24:52
HG-7-2 (Core length : 4.65m)
Latitude / Longitude (WGS84) = 32:20:10 / 130:26:51
HG-8-2 (Core length : 14.34m)
Latitude / Longitude (WGS84) = 32:20:5 / 130:27:4
HG-9-2 (Core length : 8.16m)
Latitude / Longitude (WGS84) = 32:20:2 / 130:27:12

The piston cores of HG-7-2, HG-8-2 and HG-9-2 were obtained on both sides of the graben structure around the Shirakami-iwa where the Kumamoto Prefecture carried out the previous survey.

We are now carrying out various kinds of analyses and measurements, including facies, grain size, bulk density, magnetic susceptibility, soft X-ray, tephra and 14C dating. We intend to clarify faulting history and slip per event of each target fault.

Acknowledgement

We are thankful to the local government officers involved in Kumamoto Prefecture, and the staffs of a fishermen’s cooperative association.

Keywords: Offshore active fault survey, Futagawa-Hinagu Fault Zone, Yatsushiro Sea, Piston-core

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Offshore active fault survey ”Kurehayama Fault Zone” (2) -Results of the faulting history by arrayed borehole survey

Tomoo Echigo[1*], Masashi Omata[2], Yorihide Kohriya[2], Yoshiki Mori[2], Naoko Kitada[1], Naoto Inoue[1], Reiji Tanaka[1]

[1]Geo-research Institute, [2]CREARIA Co., Ltd.

The Kurehayama Fault Zone, traversing the Toyama Plain in the NE-SW direction, from Kurehayama Hills to Toyama Bay. The north part of Kurehayama Fault Zone, respectively, lack reliable information on fault-trace distribution, activity and faulting history. Under the circumstances, we decided the following two sites (Higashi Toyama, Higatae) for paleoseismological arrayed borehole survey, based on the results of analysis data from using aerial laser survey. This project is as a part of the 2010 offshore active fault survey project funded by MEXT. The purpose of the investigation is to clarify the faulting history and activity (average slip rate) of each fault zone.

The result is as follow.
<Higashi Toyama site>
This site is located that isolated from the main flow of the Jintsu River and Joganji River. We have carried out borehole survey at 6 points. Each depth are BHT-1:10m, BHT-1.5:6m, BHT-2:10m, BHT-3:10m, BHT-4:12m, BHT-5:12m (from west to east). We confirmed three kinds of units. The stratigraphy of each points are almost same. We interpreted to pass by the active fault between BHT-2 and BHT-3. All units are thought to have deformed by the active fault, however, we could not confirm the sediments which deposited after the latest event.
<Higatae site>
This site has been located in the backmarsh near Toyama Bay. We have carried out borehole survey at 3 points. Each depth are BHG-2:7m,BHG-1:7m,BHG-3:6m (from west to east).
In cross section, it was confirmed that the basal gravel layer is tilted to the east.
From the BHG-2 and BHG-1, have accumulated thick deposits of back marsh sediments. However, we could not confirm the sediments which deposited after the latest event.

We are now carrying out various kinds of analyses and measurements, including facies, tephra and 14C dating. We intend to clarify faulting history and slip per event of target fault.

Keywords: Offshore active fault survey, Kurehayama Fault Zone, Aerial laser survey, Arrayed borehole survey, Activity

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Ground penetrating radar profiling across the Sakamoto fault and Kumeda fault in the Uemachi fault zone

Haruo Kimura[1*], Haruo Horikawa[1], Masayuki Yoshimi[1], Ryosuke Ando[1], Takumi Hayashida[1], Haruko Sekiguchi[2], Hironobu Yasuda[2]

[1]Geological Survey of Japan, AIST, [2]DPRI, Kyoto University

We carried out 200MHz ground penetrating radar profiling to reveal the shallow (about 0-8m) subsurface structure across the Sakamoto fault and Kumeda fault in the Uemachi fault zone.

Keywords: acitive fault, reverse fault, ground penetrating radar, Uemachi fault, Osaka Plain

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Holocene activity of the Kuwana fault, Central Japan

Ryutaro Naruhashi[1*], Toshihiko Sugai[2]

[1]Graduate School of F. Sci., Univ. Tokyo, [2]Graduate School of F. Sci., Univ. Tokyo

In order to verify whether the periodicity in the activity of the active intraplate fault, we estimated the Holocene activity of the Kuwana fault based on the facies analysis and the 52 accelerator mass spectrometry (AMS) ^{14}C dates from drilling cores.

In Naruhashi et al. (2008) and Naruhashi et al. (2011), five vertical slip events during the 5,000 years (7,000 yrBP-2,000 yrBP) was detected by comparing changes in the depositional rates in cores from both the hanging wall and footwall of the fault (Altitudinal difference curve: ADC). Those ages of seismic events were approximately 6600 cal yBP, 5700 cal yBP, 4000 cal yBP, 3600 cal yBP, 2100 cal yBP, A.D.745, and A.D.1586. The recurrence interval of the large earthquakes produced by Kuwana fault was 1039 years in average, and the average slip rate of the fault during the last 7000 years was approximately 1mm/y represented by the inclination of regression lines of ADCs.

Two time-displacement diagrams were constructed based on the displacement and the age of seismic event that had been calculated from ADCs for two pairs of No.200-No.350 and No.275-No.350. It is uncertain whether diagrams of the Kuwana fault follow time-predictable model.

The regeneration process model was made using the cumulative distribution function based on estimated event ages. The accumulation frequency is approximated with lognormal distribution, and is different from exponential distribution (Poisson process). This indicates that the Kuwana fault does not generate large earthquake randomly, but rather repetitively.

Based on lognormal distribution, the standard deviation of recurrence intervals for the Kuwana fault is 477 years, the relative aperiodicity (value in which standard deviation is divided by mean value) was 0.46. It is less than 420 years from A.D.1586 year when the Kuwana fault faulted at the end, thus each probability of earthquake within 30, 50, and 100 years in the future became 7.5, 8.8, and 12.4% respectively.

Keywords: Kuwana fault, Holocene, displacement, recurrence model, reverse fault

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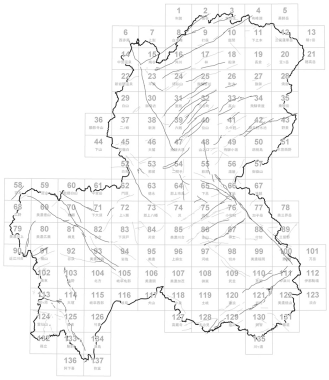
”1:25,000 Scale Active Fault Map of Gifu Prefecture” and its online release

Nobuhiko Sugito[1*], Yasuhiro Suzuki[1], Atsumasa Okada[2], Heitaro Kaneda[3], Masami Togo[4], Takashi Nakata[5], Daisuke Hirouchi[6], Mitsuhisa Watanabe[7], Chikara Uchida[8], Gifu Prefecture[9]

[1]Nagoya University, [2]Ritsumeikan University, [3]Chiba University, [4]Hosei University, [5]Hiroshima University, [6]Shinshu University, [7]Toyo University, [8]Tamano Consultants Co., Ltd., [9]None

We published ”1:25,000 Scale Active Fault Map of Gifu Prefecture” and its explanatory text in 2010, and released them online (http://www.gis.pref.gifu.jp/), in order to call attention of residents to seismic hazard. Each expert on active fault research interpreted airphotos of the entire area of the prefecture, based on the same standard as we provide ”1:25,000 Active Fault Map in Urban Area”. From the fall of 2009 to the summer of 2010, we held ten times of meetings (2-3 days for each meeting) to compile and cross-check opinions by each expert. The map shows detailed locations of the Atotsugawa, Miboro, and Nobi active fault system for the first time, which (probably) caused the great 1858 Hietsu, 1586 Tensho, and 1891 Nobi earthquakes, respectively, in addition to fault traces in the upper-reach area of the Nagara River, around Mt. Byobu, Mt. Ena, and so on. We also identified several previously-unknown active faults, and partly revised the traces of the previously-known active faults.



Keywords: active fault, tectonic landform, seismic hazard, disaster prevention, GIS, Gifu Prefecture