Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SCG68-P01 Room:Poster Time:April 30 18:15-19:30

Tectonic province of the northern Fossa Magna region based on the crustal movement and seismic activity

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The northern Fossa Magna region is located in an area where the Niigata-Kobe tectonic zone (Sagiya *et al.*, 2000) and geological strain concentration zone along the eastern margin of the Japan Sea (Okamura, 2002) is duplicated. In the past, inland crustal earthquakes, such as the Zenkoji earthquake in 1847 (M7.4) and the Niigata-ken Chuetsu earthquake in 2004 (M6.8), have occurred in this region. In order to discuss the current tectonics of the northern Fossa Magna region that has active crustal movement and seismic activity, it is necessary to clarify the characteristics of ”tectonic province”. The purpose of this paper is to reveal a detailed three-dimensional tectonic province model from the crustal movement and seismic activity of this region in the recent years. In order to clarify the characteristics of crustal movement and seismic activity, we have analyzed the GEONET observation data (from October 2007 to March 2011) using the GAMIT 10.4 software, and made the E-W cross-sectional view of the JMA hypocenter data.

The horizontal strain distribution for three and a half years just before the 2011 Tohoku-Oki earthquake shows that strain concentration zone with NW-SE directional contraction extends from the Niigata plain to the Matsumoto basin continuously. Moreover, the eastern margin of this zone corresponds roughly to the position of the Shibata-Koide tectonic line (Yamashita, 1970) running NNE-SSW direction in the eastern margin of the Niigata plain. The strain rate in the Echigo mountain range is smaller than in the Niigata plain. Takeuchi (1999) showed tectonic province based on the activity and characteristics of active faults. The strain distribution revealed from GPS data corresponds approximately to active faults provinces. The large and small strain region corresponds approximately to the reverse fault province (Shin’etsu ˜Niigata sedimentary basin) and strike-slip faults province (Central upheaval zone and Echigo mountain range) respectively. Focusing on the depth distribution of the seismogenic layer in the E-W cross-section, the depth of the lower limit of seismogenic layer is shallow (D = 10-15 km) in the strike-slip province but is deeper (D = 20-30 km) in the reverse fault province. The seismogenic layer is located beneath the low P-wave velocity zone corresponding to the thick sediments layer in the sedimentary basin.

According to the above results, there is obvious spatial variation of the depth of seismogenic layer and strain distribution at the boundary of the sedimentary basin and Central upheaval zone. It is conceivable that two different tectonic provinces are adjacent along the tectonic boundary where characteristics of the crustal activity are changing greatly. The moderate-large crustal earthquakes around the northern Fossa Magna, such as the Zenkoji earthquake in 1847, the Niigata-ken Chuetsu earthquake in 2004 and the Nagano-ken Hokubu earthquake in 2011, have occurred on or near the tectonic boundary. Stress concentration is likely to occur due to large changing of the physical properties in the tectonic province boundary, and a large crustal earthquake tend to occur at the tectonic province boundary than at the inside province.

Keywords: tectonic province, northern Fossa Magna, crustal movement, seismic activity, seismogenic layer

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Results of 2013 Off-Kanazawa and Noto peninsula survey for the integrated research project on seismic and tsunami hazard

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To estimates Tsunami and seismic hazards along the coastal area of Sea of Japan, more detailed survey to identify source faults are needed. A new research project funded by MEXT named ”the integrated research project on seismic and tsunami hazards around the Sea of Japan” began in FY 2013. To obtain the information of source faults, we performed deep seismic reflection profiling off-Kanazawa and Noto area in the central part of Honshu, Japan. The source faults were estimated together with the results of seismic sections in the epicentral area of the 2007 Noto peninsula earthquake (Sato et al., 2007, BERI). We used two vessels; a gun-ship with 3020 cu. inch air-gun and a cable-ship with a 2-km-long, streamer cable with 156 channels and 480 cu. inch air-gun. Common-mid point reflection data were acquired along 4 seismic lines with total 245 km in length. The seismic profiles portray the reactivation of normal faults, which formed during syn-rift periods, associated with the opening of the Sea of Japan. 2007 Noto peninsula earthquake occurred by the oblique motion on source fault dipping 60 degrees, which is favorable normal faulting. The back arc side of the SW-Japan arc experienced NS trending shortening deformation in the latest Miocene. From the Noto peninsula to the west, undeformed Pliocene sediments covers folded Miocene. Some normal faults reactivated as active strike-slip and reverse faults in Quaternary. The survey results contributed to construct source faults models of Tsunami and seismic hazards estimation.

Keywords: Sea of Japan, source fault, crustal structure, seismic reflection profiling, Off-Kanazawa, Off-Noto Penisula

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Results of 2013 Off-Joetsu survey for the research project on seismic and tsunami hazards around the Sea of Japan

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To estimates Tsunami and seismic hazards along the coastal area of Sea of Japan, more detailed survey to identify source faults are needed. A new research project funded by MEXT named ”the integrated research project on seismic and tsunami hazards around the Sea of Japan” began in FY 2013. To obtain the information of source faults, we performed deep seismic reflection profiling off-Joetsu area in the central part of Honshu, Japan. The seismic lines were located in the offshore extension previous onshore seismic lines forming onshore-offshore integrated seismic lines. We used two vessels; a gun-ship with 3020 cu. inch air-gun and a cable-ship with a 2-km-long, streamer cable with 156 channels and 480 cu. inch air-gun. Common-mid point reflection data were acquired along 3 seismic lines. Two offshore seismic lines are connected to the onshore seismic sections. The survey area consists of stretched continental crust, such as Noto peninsula and Sado island, and failed rift area with large amount of large mafic intrusive rocks, such as Sado strait and Toyama trough. Stretched continental area is marked by densely distributed syn-rift normal faults. On the other hand, in the Sado strait and Toyama trough, fault-related folds were developed, which show small amount of vertical displacement. Along the boundary between continental crust area and oceanic crust, thrusts with rift axis vergent well imaged by seismic reflection profiles. The survey results contributed to construct source faults models of Tsunami and seismic hazards estimation.

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Onshore offshore, deep seismic survey across the Toyama trough

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To estimates Tsunami and seismic hazards along the coastal area of Sea of Japan, more detailed survey to identify source faults are needed. A new research project funded by MEXT named " the integrated research project on seismic and tsunami hazards around the Sea of Japan " began in FY 2013. To obtain the information of source faults, we performed onshore offshore deep seismic reflection profiling across the Toyama trough. The seismic line extends from Unazuki at the foot hill of the Hida mountains to the shoreline for 15 km and connected with bay cable of 3 km in length. Seismic signals produced by four vibroseis trucks were recorded by onshore receivers and bay cable. For offshore, we used two vessels; a gun-ship with 3020 cu. inch air-gun and a cable-ship with a 2-km-long, streamer cable with 156 channels and 480 cu. inch air-gun. The P-wave velocity profile by refraction tomography, suggests that the upper surface of Vp 5 km/sec is located 5 km below the mean sea level at the Toyama trough. Vertical offset of Vp 5 km/sec layer is about 8 km. Trough fill sediments beneath the Kurobe alluvial fan show northward dipping. Beneath the apex of this fan, velocity profile and reflection profile suggest the existence of south dipping thrust at 4 km in depth. This fault extends northward as a blind thrust. The seismic section suggests the reverse fault at the northern edge of Toyama trough. Based on the distribution of 5e coastal terraces along the southern part of Noto peninsula, the reverse fault prayed a significant roll for the uplift of Noto peninsula. Such basin structure is analogues to the Niigata sedimentary basin, and northern Fossa magna basin. The survey results contributed to construct source faults models of Tsunami and seismic hazards estimation.

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Structure analysis of the Ryukyu arc by the receiver function

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The Ryukyu arc have converted plate boundary and back arc basin. The volcanic front in Tokara Islands is the main volcanism. Moreover, The activity of shaped Trough is supposed (Kimura, 1985). In addition, by the survey of igneous activity, the Okinawa Trough have upper flow mantle. Analyzed by receiver function in the Ryukyu arc, McCormack et al., (2013) ware anisotropy structure of slab beneath F-net station.

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However, it was unknown how changed the structure in the slab and wedge mantle structure changed in the subducting direction. Therefore we clarified I sank by making a receiver functional analysis section at right angles to an errand, the trench including a seismometer record in addition to F-net broadband seismometer record in a short period of the Japan Meteorological Agency,(JMA) and how a Slavic angle changed into the direction.

In the receiver function analysis, we use 8 of short-period seismograph by JMA and 3 of broadband seismometers by NIED F-NET established in central Ryukyu . An analysis period is 2002 to 2013. and used 113 remote earthquake events more than M6.0 for analysis.

In receiver functional analysis, the discontinuity imaging depth is as same as JMA , in Okinawa-honto beneath 40km.

Keywords: receiver function, Ryukyu arc, mantle wedge