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

SSS34-P14 会場:3 階ポスター会場 時間:4 月 29 日 18:15-19:30

Investigating the role of the Itoigawa-Shizuoka tectonic line in the evolution of the Northern Fossa Magna rift basin

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The Itoigawa-Shizuoka tectonic line (ISTL) fault system is considered to have one of the highest probabilities for a major inland earthquake occurrence in the whole of Japan. It is a complex fault system with the dip directions of the local fault segments changing from north to south between an east-dipping low-angle thrust fault, a strike slip fault and a west-dipping thrust fault. The tectonic relations between the different parts of the fault system and the surrounding geological units are yet to be fully explained. This study aims to reveal the juncture of the northern and central parts of the ISTL and investigate its contribution towards the shaping of the Northern Fossa Magna rift basin. We conducted 3 deployments of 1 or 2 linear arrays of seismic stations across the central and northern ISTL regions and observed local micro-earthquakes for a period of 3 years. Each deployment recorded continuous waveform data for approximately 3 months. Using arrival times of 1193 local earthquakes, we jointly determined earthquake locations and a 3D velocity model, applying the tomography method. We were able to image the regional crustal structures from the surface to a depth of 20 km with a spatial resolution of 5 km. Subsequently, we used the obtained 3D velocity model to relocate the background local seismicity from 2003 to 2009. The juncture of the northern and central parts of the ISTL was well constrained by our results. The depth extension of the northern parts of the ISTL fault segments follows the bottom of the Miocene Northern Fossa Magna rift basin (NFM) and forms an east-dipping low-angle fault. In contrast, the central parts of the ISTL fault segments are estimated to lie along the eastern boundary of the Matsumoto basin forming an oblique strike slip fault.

キーワード: Itoigawa-Shizuoka tectonic line, tomography
Keywords: Itoigawa-Shizuoka tectonic line, tomography