論文内容の要旨

論文題目：P- and S- wave velocity structure in and around the Itoigawa-Shizuoka Tectonic Line (ISTL) fault system revealed by dense seismic array observations

（稠密地震観測による糸魚川ー静岡構造線断層帯（ISTL)付近のP波、S波速度構造）

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● Introduction

The Itoigawa-shizuoka tectonic line (ISTL) is a major tectonic structure that divides Japanese Island arc into northeast and southwest parts. It was formed as a normal fault in the early Miocene and represents the southwestern boundary of the northern Fossa Mangna rift basin to the north (Sato et al. 2004), and the boundary between the Japanese arc accretionary prism units and the Izu-Bonin arc crust to the south (Kano 2002). There are several studies along the ISTL that have provided us with the shallow structure of the different fault segments along the ISTL (Sato et al. 2004, Ikeda et al. 2004,2007) and the detailed crustal structure in the northern ISTL (Kurashimo & Hirata 2004), but the detailed crustal structure in the central and southern parts is yet to be revealed. Previous to the present study, large scale central Japan tomography studies have provided us only a general image of the deeper crustal structure along ISTL (Nakajima & Hasegawa 2007, Kamiya & Kobayashi 2007).

Also, there is neither any study up to now that correlates the present time seismicity with the active parts of the south and central ISTL fault system, nor any comparative study along the ISTL that explains the tectonic evolution of the whole complex fault system. The present study aims to observe and accurately locate the local seismicity in the area. The purposes of the study are to derive a 3D velocity model for the south and central ISTL region and to correlate it with the geologic structures in the area. Also, I will correlate the regional seismicity with the deeper structure of the south and central ISTL fault system and finally compare the crustal structure in the north, south and central ISTL areas to understand the tectonic evolution of the complex fault system.

● Observations

The online permanent seismic station network in the area is not sufficient to accurately locate the earthquakes happening in the area and also not dense enough to provide us with the detailed structure of the earth's crust. The past 3 years I have installed temporary seismic stations in the south and central part of the STL. In detail, I have deployed 58 stations in the area south of lake Suwa from 25th of August 2003 to 16th October, 60 stations in the southern Alps and Kofu basin areas from 16th September 2005 to 22nd December 2005, 60 stations in the area north of lake Suwa from 12th September 2006 to 12th December 2006 (Fig. 1).The instruments I use are 3 - component 1-Hz seismometers and long-term off-line recorders operated by dry batteries (Shinohara et al. 1997).

● Data and Analysis

I have combined the data retrieved from the temporary stations, which I have deployed, with the data available from the online permanent stations in the ISTL area. I have manually re-picked 63,275 P- and 68,847 S- wave arrival times from 1,945 events from the 5 th August 2003 to 31st December 2006. I used the Double Difference tomography method (Zhang and Thurber, 2003) in order to accurately relocate the hypocenters and obtain a 3D P- and S- wave velocity (Vp and Vs) structure beneath the southern Japanese Alps, the Kofu basin and northern of lake Suwa. In the entire ISTL region, I have selected 1,510 events that have more than 10 P-wave arrivals. I have used these events to estimate a regional 3D Vp and Vs model, using the online stations and some of the temporary array stations. Consecutively I have used the previously obtained model as an initial model, for a very fine local tomography imaging of the crustal structure beneath the temporary array stations.

- Result and Discussion

The relocated hypocenters in the southern ISTL coincide with the deeper extension of the active faults in the area. The relocated hypocenters are deeper than those reported by the Japan Metrological Agency (JMA) in the northern ISTL and shallower at the central and southern parts. The tomographic analysis has provides us with a detailed Vp and Vs image of the crust in the area below the ISTL. The 3D velocity model of the crustal structure in the area that I have acquired by the present study is in accordance with the geological boundaries.

- Conclusion

(1) The average depth of the hypocenters is shallower in the northern ISTL (3 - 8 km) and gets progressively deeper towards the central (8-15 km) and southern (15-25 km) ISTL.
(2) The north tomograms fit accurately with the deeper extension of the Matsumoto basin and the central uplift zone geological units (CUZ)(Fig.2 (a)). In the central ISTL, the Yatsugatake volcano magmatic conduit was imaged (Fig. 2(b)). In the southern ISTL, I imaged the downwards continuation of the low grade metamorphic rocks that constitute the Chichibu-Shimanto belts of the southwest acrretionary prism of the Japanese arc, and of the igneous rocks that form the Izu-Bonin arc crust (Fig.2(c)).
(3) Change of the structure along the ISTL was discussed: from an east dipping fault in the north to a west dipping fault in the south (Fig. (2)).

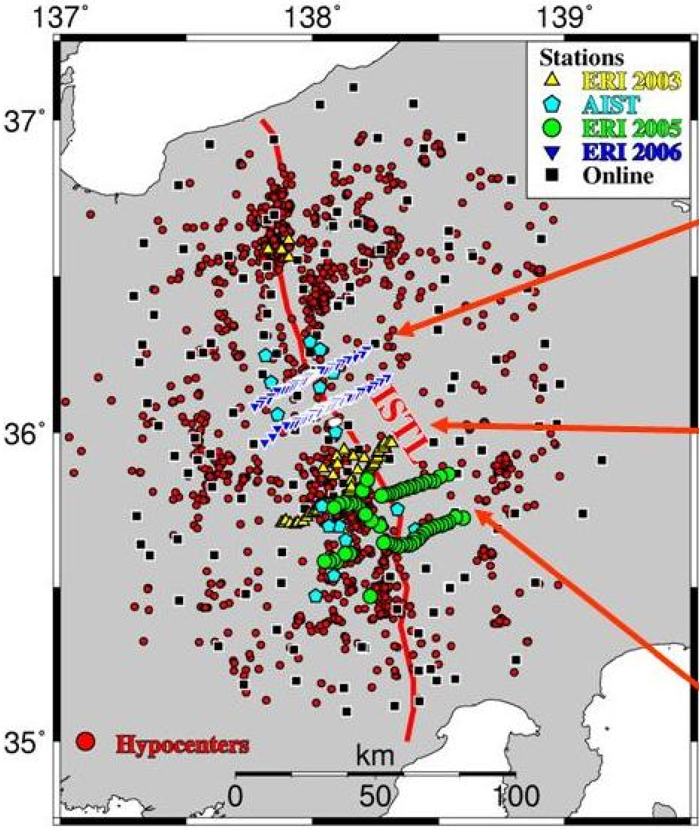

Figure 1. Studied area. Colored symbols are temporary and permanent stations. Red solid circles are epicenters.

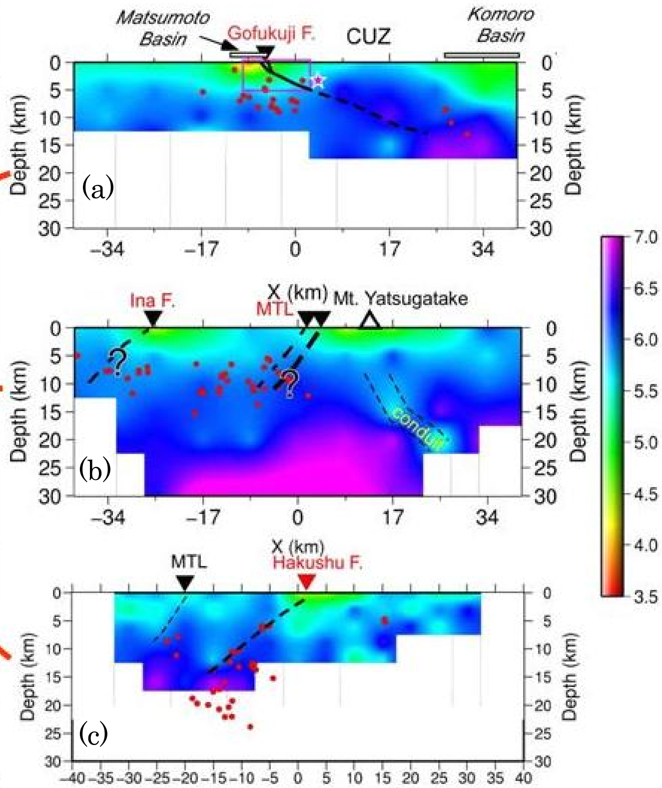

Figure 2. Cross sections of Vp perpendicular to the different segments of the ISTL. (a) northern, (b) central, and (c) southern areas.