

Subduction zone studies in Japan and contributions to subduction zone studies in New Zealand

Shuichi Kodaira, JAMSTEC

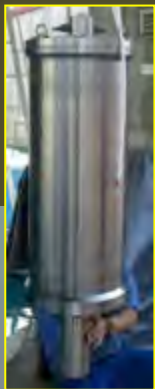
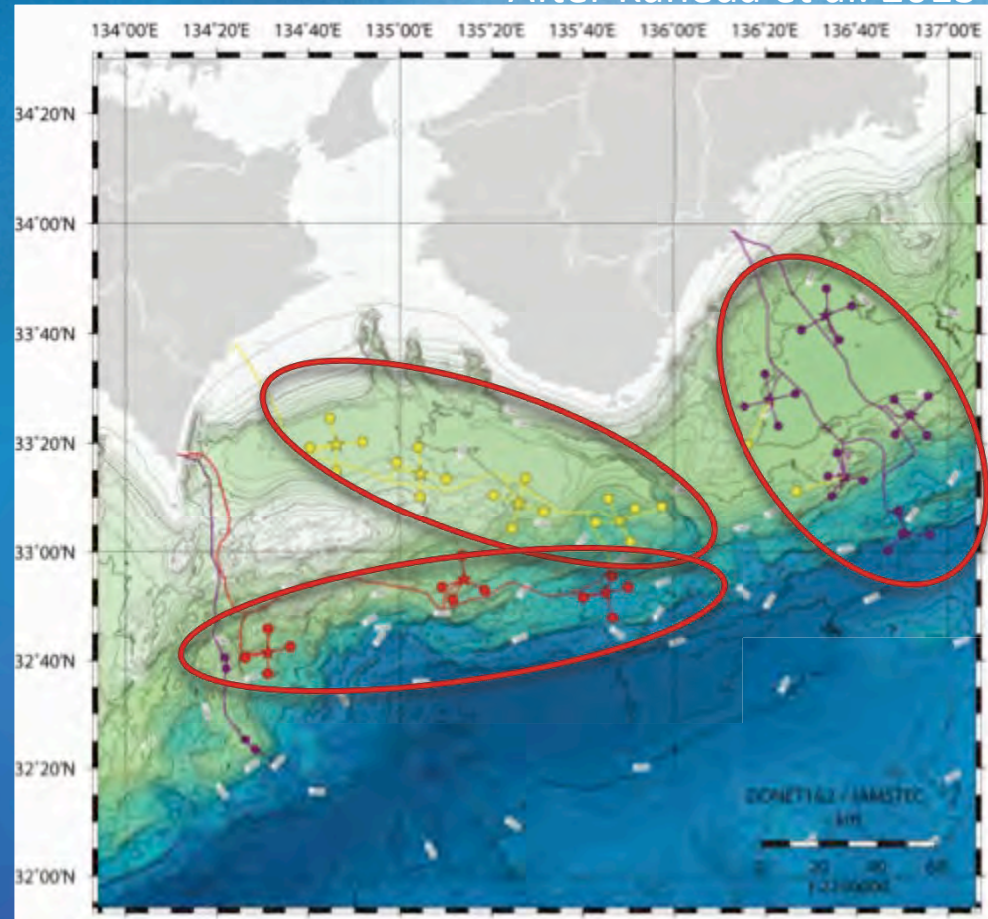
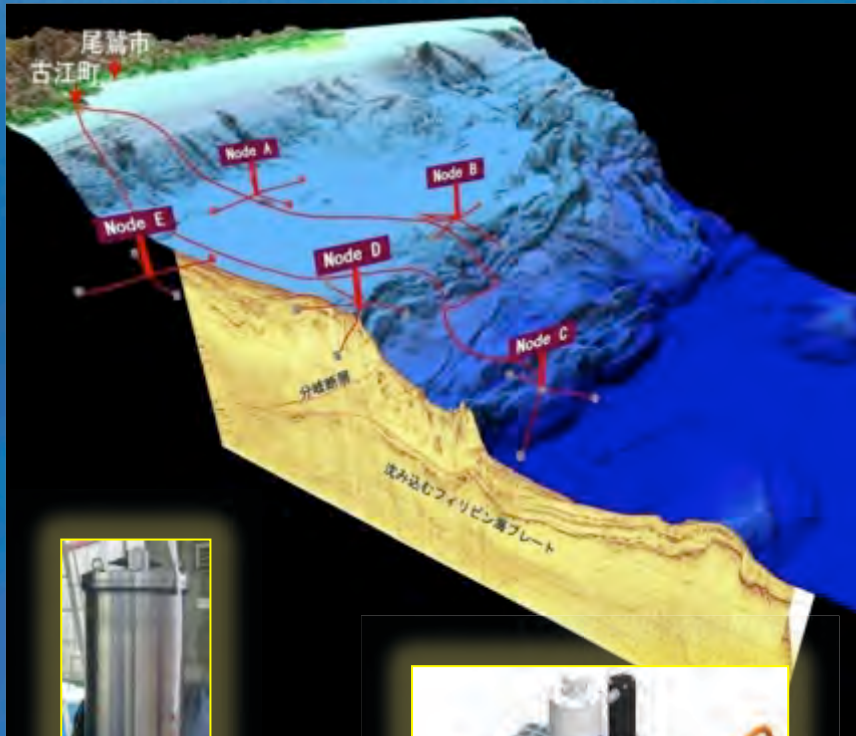
with contributions from Y. Kaneda, A. Nakanishi, T. No,
N. Takahashi, Y. Tamura (JAMSTEC),
K. Mochizuki, M. Shinohara (Univ. Tokyo)
Y. Ito (Tohoku Univ.)

- **“Scientific infrastructure and potential funding resources to conduct subduction studies in New Zealand”**
- **Seismogenic zone studies around Japan**
 - **DONET+NanTroSEIZE,**
 - **Nankai Earthquake Hazard Project**
 - **JFAST+ Geophysical studies in the Japan Trench**
- **Contribution to seismogenic zone studies in New Zealand**
- **Scientific infrastructure and Fund**

DONET

Dense Oceanfloor Network system for Earthquakes and Tsunamis

After Kaneda et al. 2013



Broad Band Seismometer
Strong Ground Motion seismometer
Pressure sensor, Thermometer

DONET: in operation

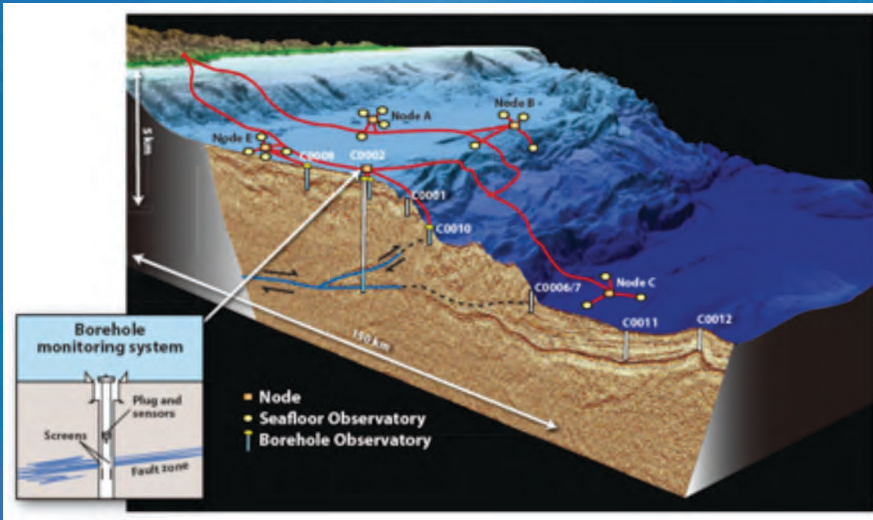
DONET2 Phase 1: start operating in 2013

DONET2 Phase 2: deploy cable in 2014

DONET + NanTroSEIZE

● A Stethoscope on Earthquake Faults

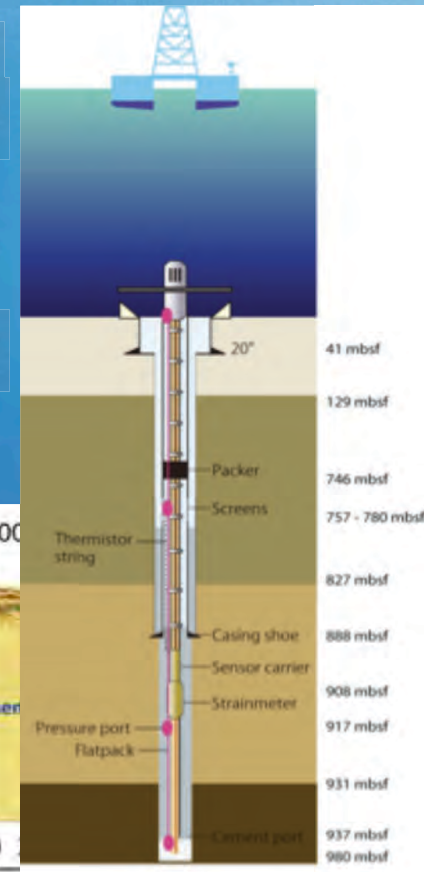
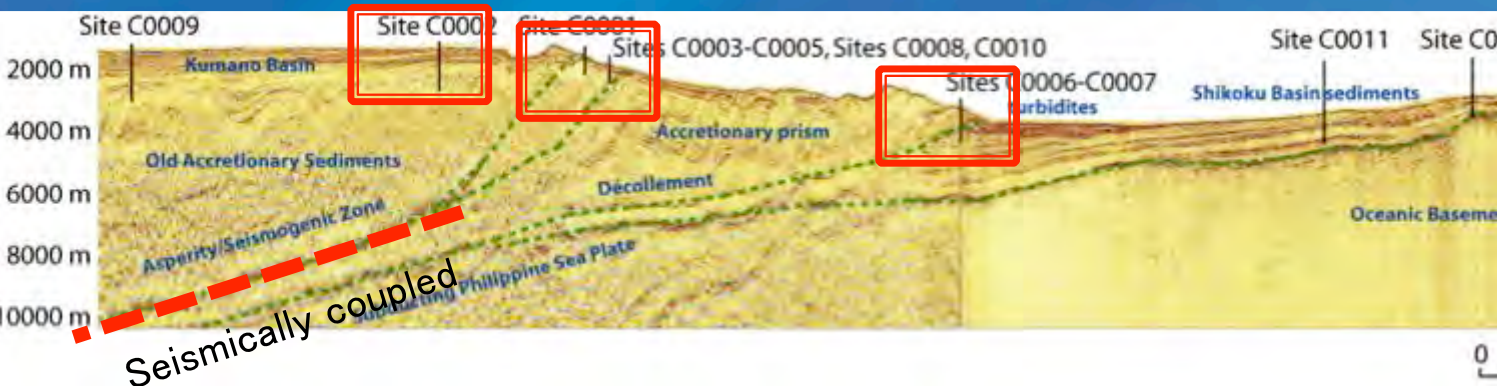
After "Illuminating Earth's Past, Present, and Future"



C2: in operation, connected to DONET
Seismometer (Broad Band, Strong Motion)
Strain meter, Tiltmeter, Pressure, Temperature

C10: plan to deploy sensors and connect to DONET in FY2013

C6: plan to deploy sensors and connect to DONET in FY2013



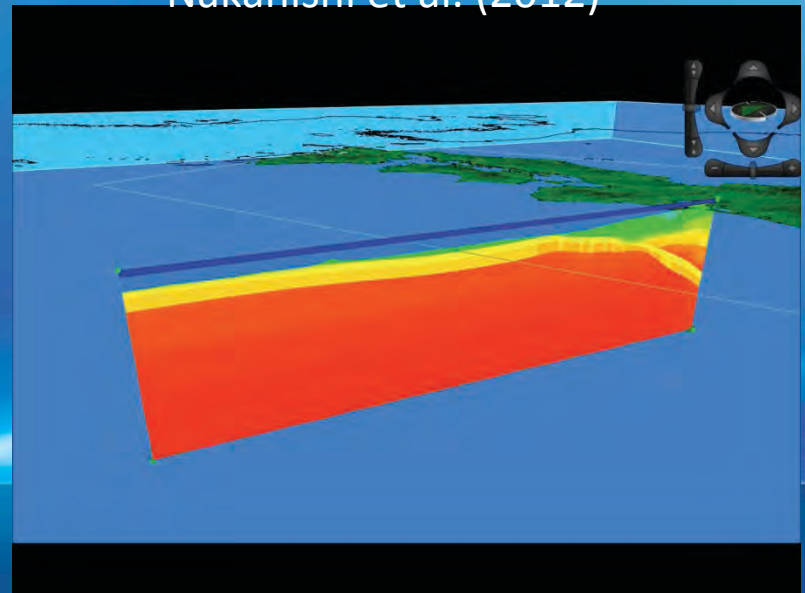
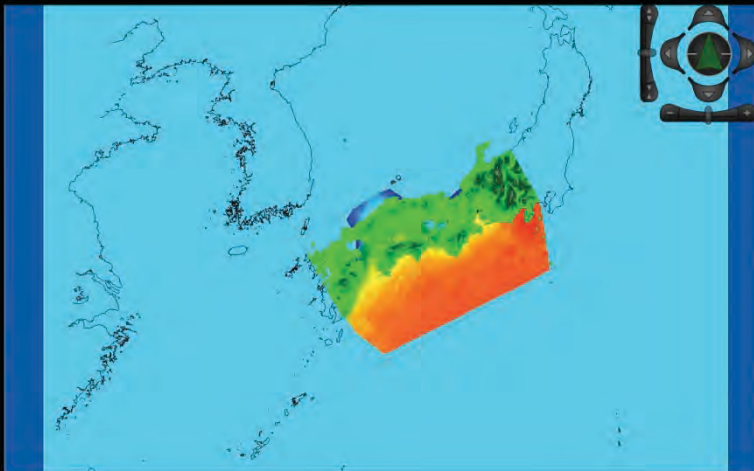
Nankai, Tonankai, Tokai Project

- Integrated Project including Earthquake science, Earthquake engineering and Social science



- Completed the 5-years active source study to map a detailed plate geometry and velocity structure
- The model will apply to earthquake simulation
- **New 8-years project will start**
 - **Fine image of SSE region**
 - **High resolution seismic image of frontal thrust**
 - **Survey in the Ryukyu trench,**

Nakanishi et al. (2012)



Japan Trench: JFAST and Geophysical surveys

JFAST: to examine frictional property of seismogenic fault

Kodaira et al., 2012

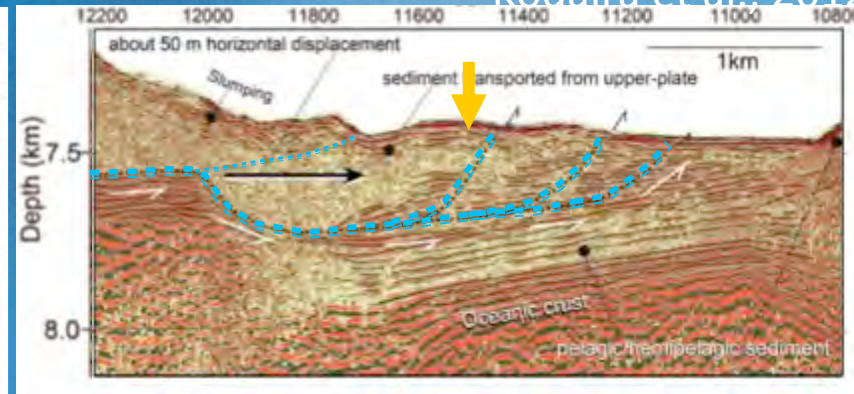
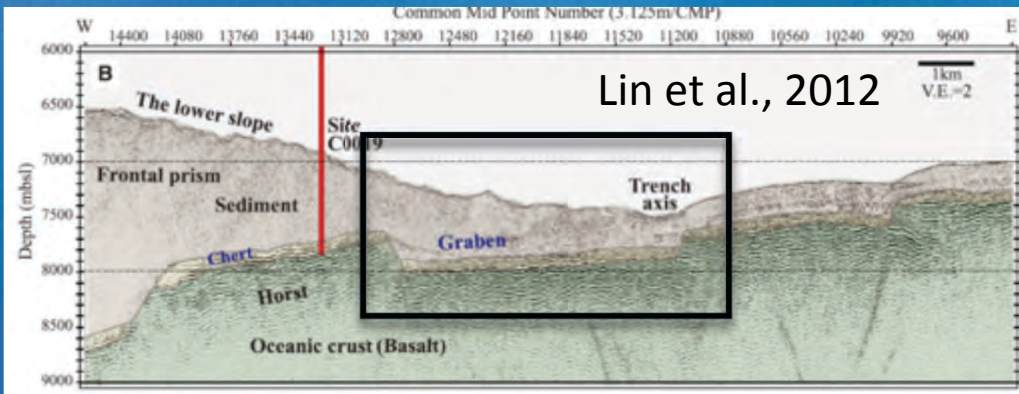
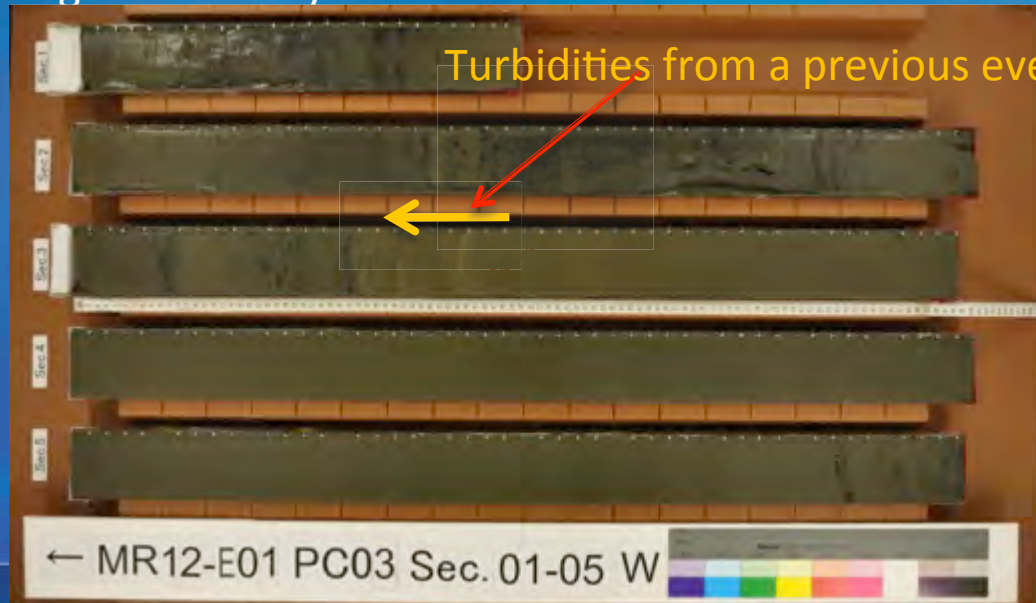
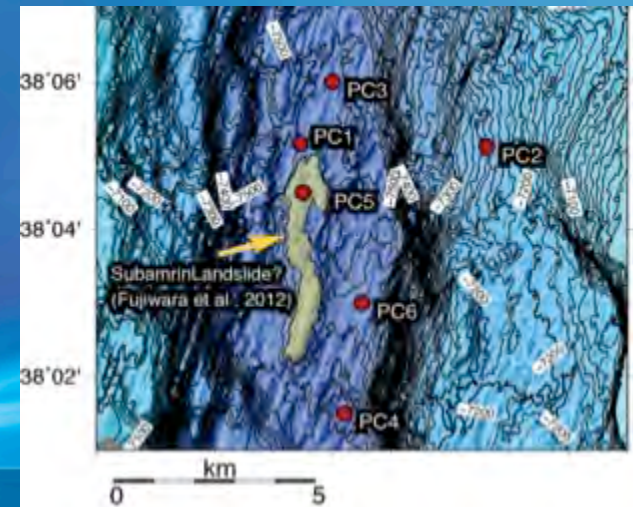


Figure courtesy of T. Kanamatsu and K. Ikehara

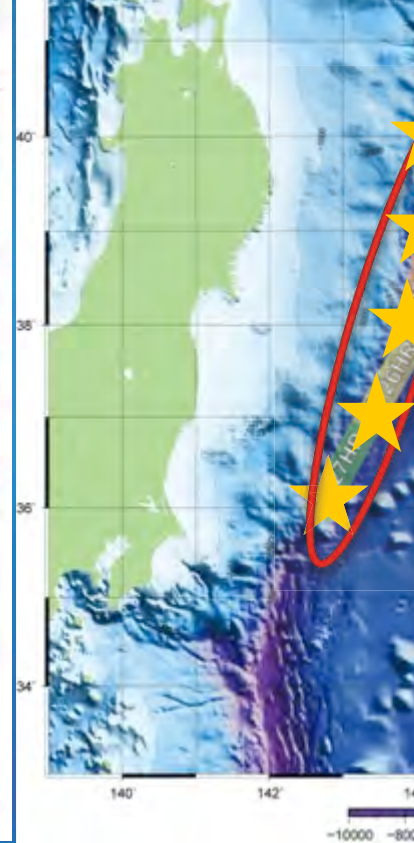
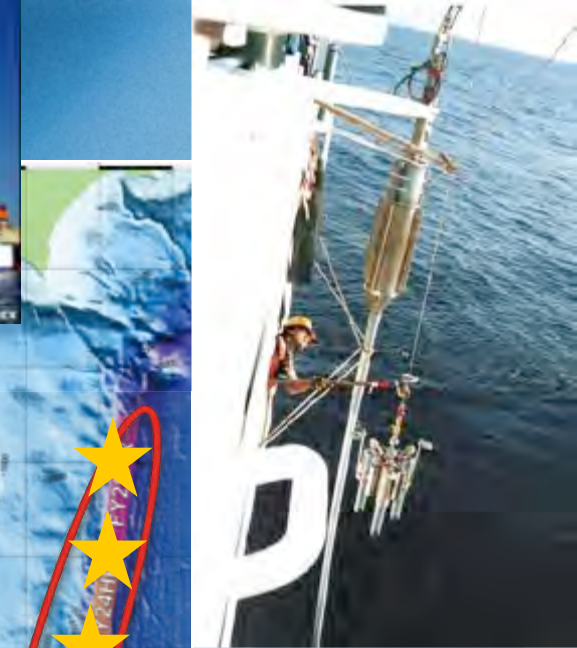
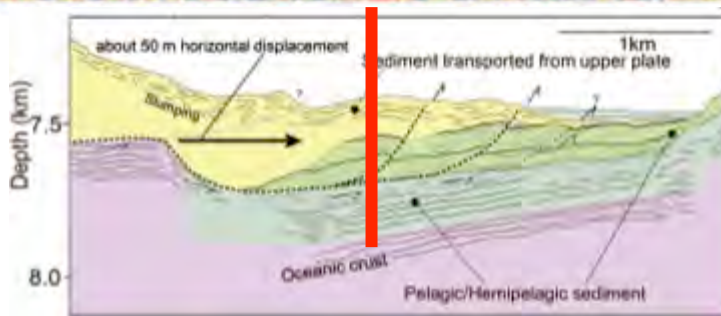
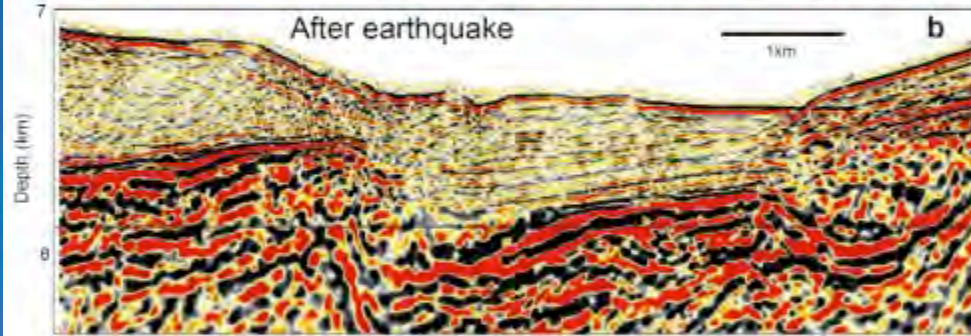
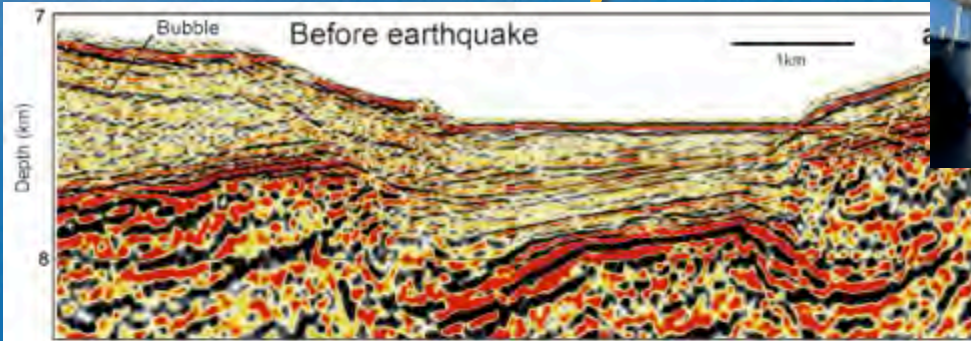


High resolution seismic showing seismogenic fault reaching to the trench



Piston coring: to obtain earthquake record

Future study



Deformation structure in the trench-filled sediment may preserve a long term record of a “slip-to-the-trench” event

High resolution seismic surveys along the trench and piston coring

Shallow drilling transect along the axis

Incoming plate: structural variation and stress regime

regime

Fujie et al., 2013

Aftershock observation

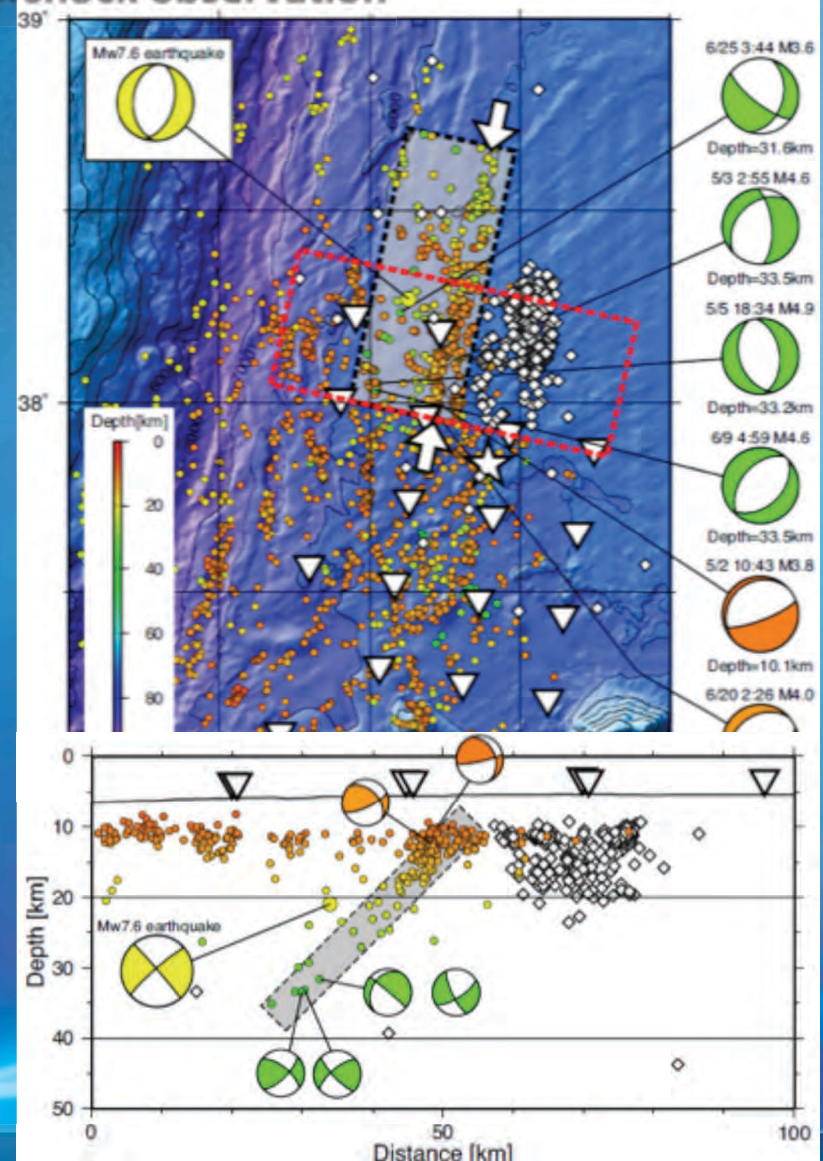
Obana et al., 2012



Ceramic sphere Ultra-deep OBS

Vp/Vp increase toward the trench.
This may indicate hydration of oceanic crust due to bending related fault

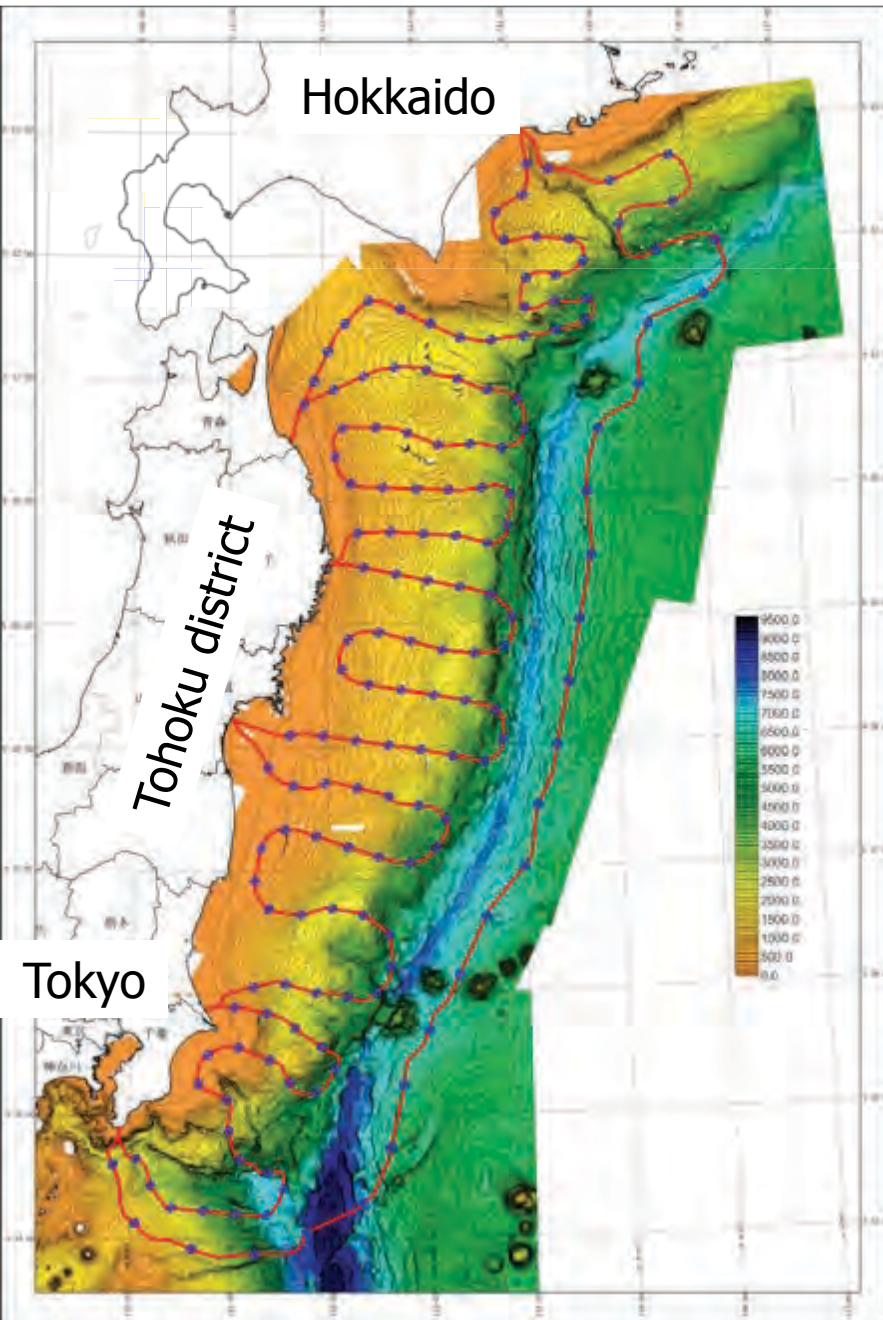
Stress regime of incoming plate became extension down to 35 km deep after the Tohoku-oki earthquake



Developed ~9000 m-class ultra-deep OBS

Plan for installation of LS-OBCS

Shinohara et al. 2012



- The network covers trench region from off-Hokkaido to off-Tokyo (approx. 1,100km x 300 km area)
- Total 154 Observation Nodes (ON), each ON has seismometers and tsunami gauges.
- The network consists of 6 cable system. 5 cable systems have 25 ONs with 30km interval. Another has 29 ONs with 60 km int.
- Both cable and ONs will be buried at water depths shallower than 1,500m.
- There are 6 landing stations.
- Power is supplied from both end of cable, and data are also sent to both end of cable.

- “scientific infrastructure and potential funding resources to conduct subduction studies in New Zealand”

- **Seismogenic zone studies around Japan**

- DONET+NanTroSEIZE,

- Nankai Project

- JFAST+ Geophysical studies in the Japan Trench

- **Contribution to seismogenic zone studies in New Zealand**

- **Scientific infrastructure and Fund**

Contribution to subduction zone study in New Zealand

Motivation: Zealand

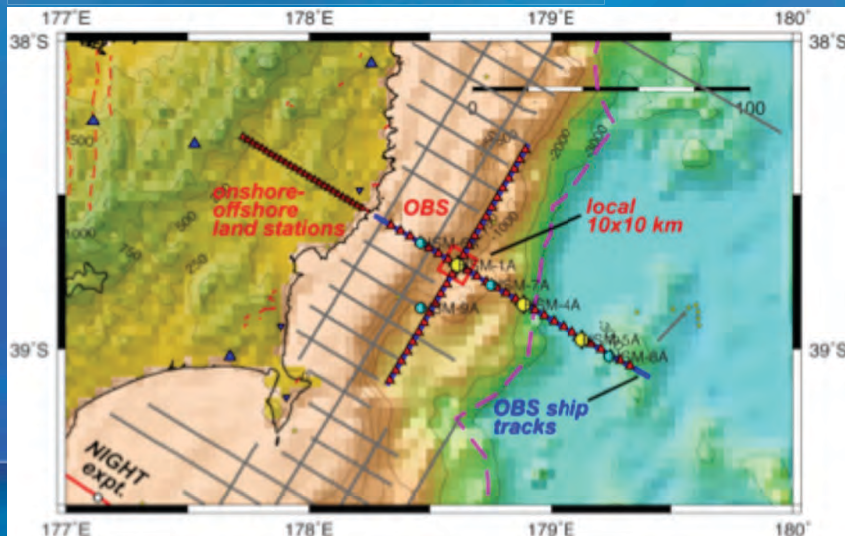
Comparative studies in the circum-Pacific subduction zone for global understanding subduction zone dynamics

Past and on-going projects:

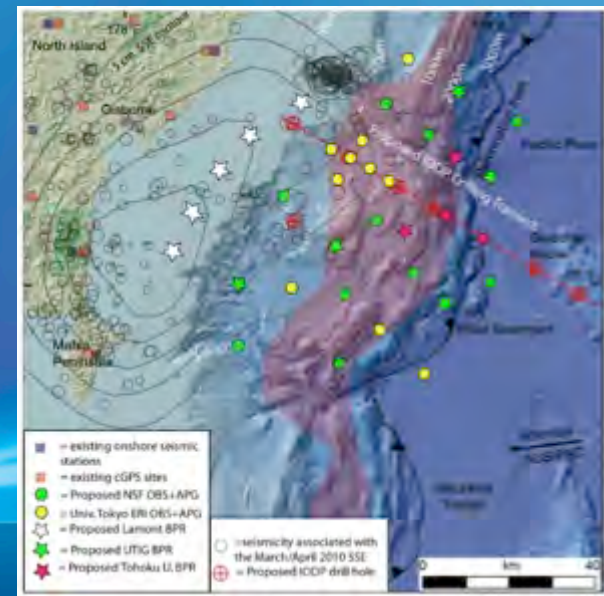
- SAHKE by Tokyo Univ and GNS,
- BBOBS/OBP study by Tokyo Univ. and Tohoku Univ.

Possible future collaboration:

- BBOBS, OBP, GPS/A study by Tokyo Univ, Tohoku Univ.
- Active-source OBS survey in Hikurangi
- IODP Hikurangi Project



(Okaya et al.)



(Wallace et al.)

Scientific infrastructure and Fund

Research vessel:

- JAMSTEC's vessel, a proposal can be submitted through Japanese partners

Seismic system:

- R/V KAIREI, 444ch streamer, 7200 cu. inch air-gun array, ~150 SP OBS, portable high resolution streamer cable (6.25 ch. interval, 196ch)

BBOBS, Ultra-deep OBS, OBEM, OBP, GPS/A:

- ERI, Tohoku Univ., JAMSTEC, JCG

JAMSTEC new vessel will be delivered in FY2015

- 3D seismic, new OBS system, BMS, ~40m piston corer

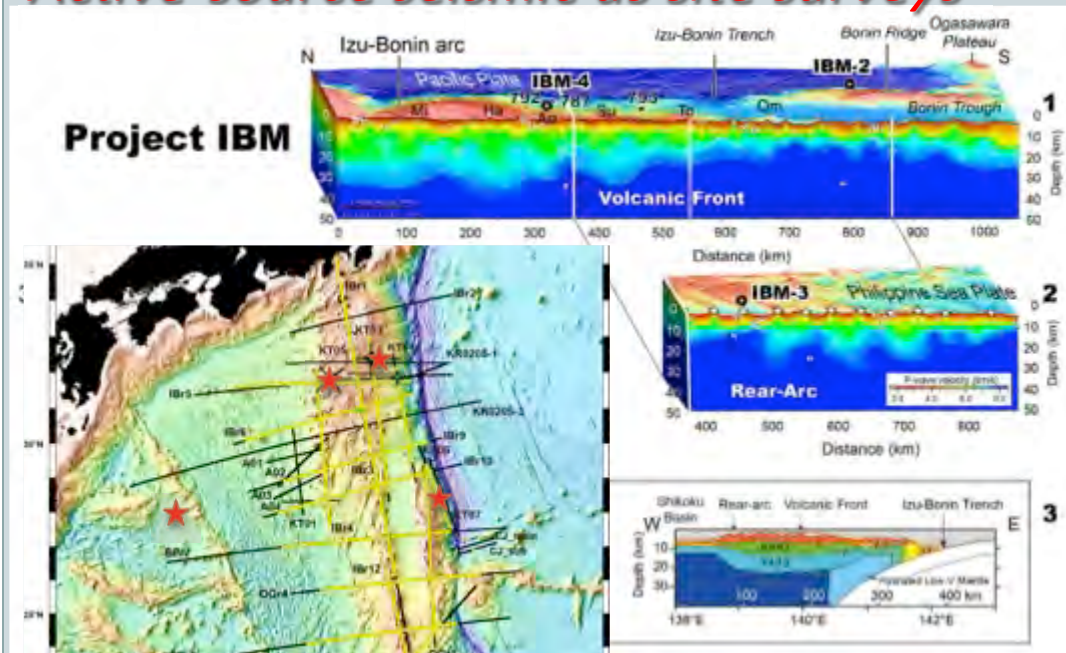
"KAKENHI", JSPS research fund

- SAHKE in NZ, SeaJade in Cascadia were funded by KAKENHI Category (A), 50 M yen for 4-years.
- Category (S), ~200 M yen for 4~5-years.

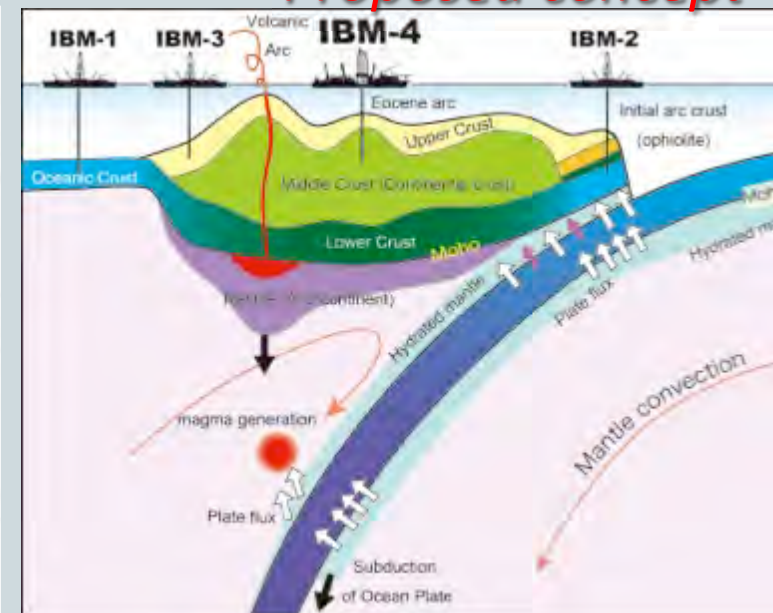


Project IBM: towards comprehensive understanding of arc evolution and continental crust formation

Active-source seismic as site surveys



Proposed concept



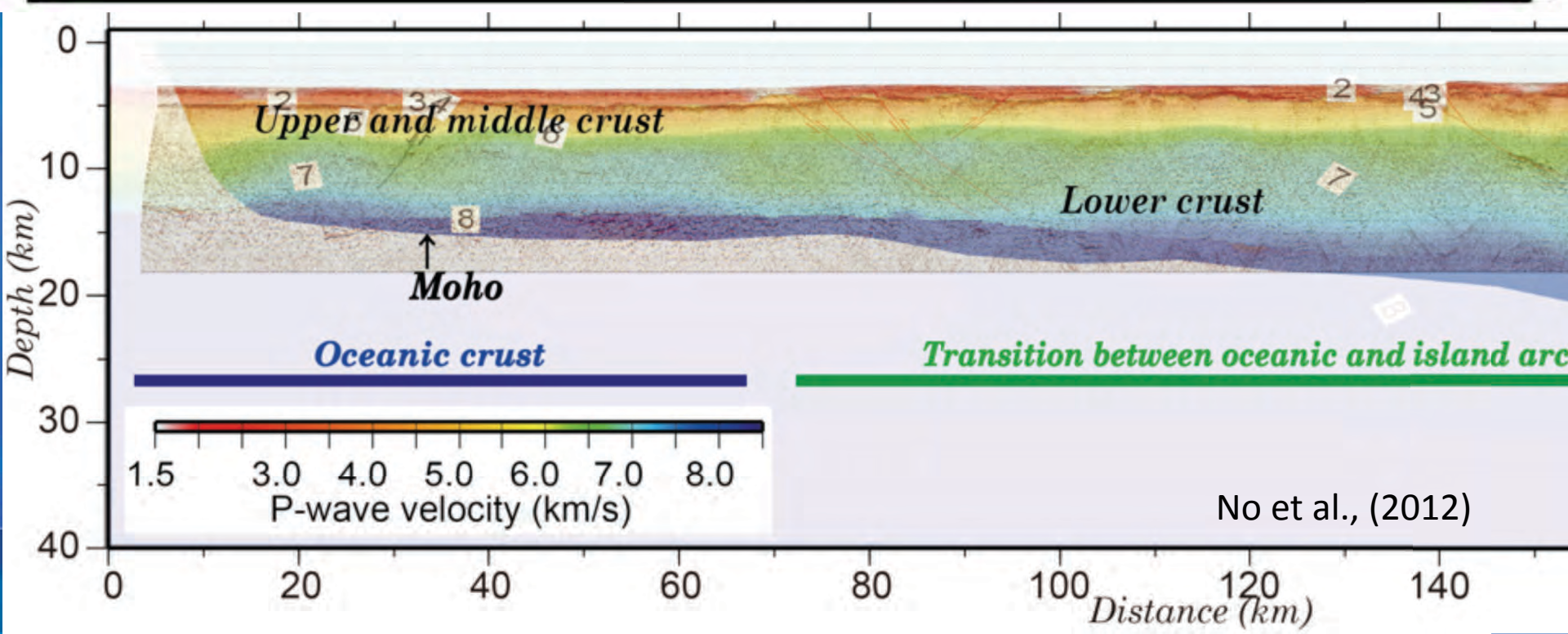
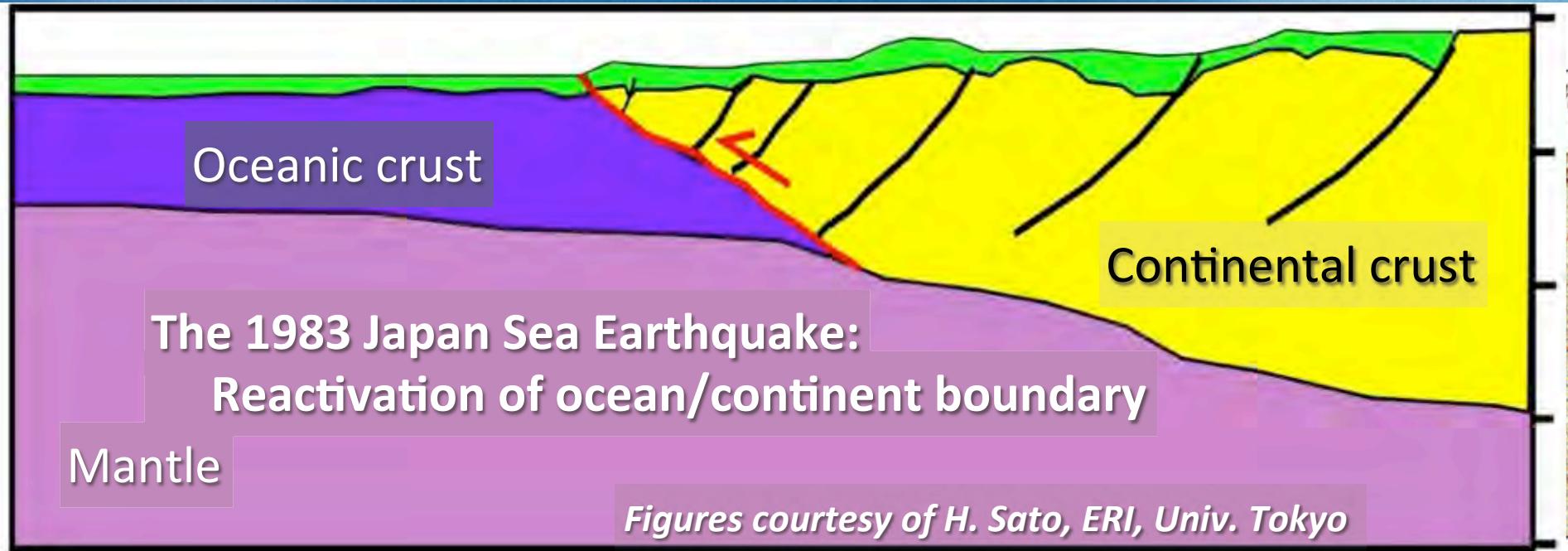
Exp. 350: IBM-3 (697-Full3) Izu Rear Arc; **The Rear Arc: the Missing Half**

Exp. 351: IBM- 1 (695-Full2) Amami Sankaku Basin; **Pre-existing Crust and Mantle**

Exp. 352: IBM-2 (696-Full4) Bonin Ridge; **Initial Arc Crust and Subduction Initiation**

Exp. Chikyu: IBM-4 (698-Full3) Izu Forearc; **Ultra-Deep drilling to the Middle Crust**

Figures courtesy of Yoshihiko Tamura, IFREE JAMSTEC



Seismogenic zone in western Japan Sea

