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## Deep seismic reflection profiling across the central part of Northern Honshu arc, Japan

**Hiroshi Sato**<sup>1</sup>, Tatsuya Ishiyama<sup>1</sup>, Hidehiko Shimizu<sup>2</sup>, Naoko Kato<sup>1</sup>, Masanao Shinohara<sup>1</sup>, Takaya Iwasaki<sup>1,5</sup>, Hirokazu Ishige<sup>2</sup>, Shinji Kawasaki<sup>2</sup>, Susumu Abe<sup>2</sup>, Makoto Matsubara<sup>3</sup>, Testuo No<sup>4</sup>, Shuichi Kodaira<sup>4</sup>, and Naoshi Hirata<sup>1</sup>

<sup>1</sup>ERI, The University of Tokyo, Tokyo, Japan (satow@eri.u-tokyo.ac.jp)

<sup>2</sup>JGI, Inc.

<sup>3</sup>National Research Institute for Earth Science and Disaster Resilience

<sup>4</sup>Japan Agency for Marine-Earth Science and Technology

<sup>5</sup>Association for the Development of Earthquake Prediction

Northern Honshu, Japan, is a classic example of compressive island arc forming a trench-arc-backarc basin and was rifted away from the Asian continent in Miocene. The subduction of the Pacific plate generates megathrust earthquakes, such as the 2011 Tohoku-oki earthquake (M9) and an overriding plate deforms associated with M7-class reverse faulting. The amount of shortening is largest where along the Miocene failed rift basin, the Neogene post rift sediments form a fold-and-thrust belt. To understand the mechanisms of the deformation of overriding plate and generation of devastating earthquake, to reveal the detailed lithospheric structure of overriding plate is significant. In 2019, an onshore-offshore seismic reflection profiling was performed across the Japan trench to the axial part of the backarc basin. Here we focus on the crustal structure of the onshore section across the central part of northern Honshu.

The length of onshore seismic line is 160 km within the total 850-km-long seismic line. The air-gun shots in the forearc and backarc sides were recorded by onshore seismic line using 1616 fixed channels. Onshore seismic sources were four vibroseis trucks and dynamite shots. To obtain the deep crustal image, we used low-frequency signals. The produced sweep frequency was 3 to 40 Hz and seismic signals were recorded by 4.5 and 5 Hz geophones. Sets of 150 stationary vibroseis sweeps were performed at about 10 km interval along the seismic line. By conventional common-midpoint reflection methods and refraction tomography reveal the crustal structure down to 10 km. Together with the velocity structure obtained by earthquake tomography (Matsubara et al., 2019). Lithospheric structure is estimated by velocity structure obtained from active and passive sources, and geological data.

With seismic reflection profiles in the forearc (Miura et al., 2005) and backarc (No et al., 2014), the onshore seismic section portrays the first image of the seismic reflection profile across the Northern Honshu arc from the trench to the backarc basin. The basic structure of the over ridding plate were formed by the rifting of backarc opening stage. Most of the active faults inherited from

the Miocene normal faults. The formation of backarc basins were achieved by the development of multi-rift systems. An axial part of failed rift within a continental crust is marked by a higher P-wave velocity lower crust, thick post-rift sediments overlaid by thick basalts. The failed rift is bounded by faults dipping to the outward of rift axis associated with mafic intrusion in a rift axis. The reverse faulting of the rift-bounding faults produced a fold-and-thrust belt in the post-rift Neogene basin fill. Judging from the tectonic geomorphological and geological features, these faulting and fault-related folding are active in late Quaternary. Detachment in this fold-and-thrust belt commonly accommodates in over pressured mudstone units in the rift basin. The major style of deformation of backarc is basement involved normal faults. Reactivation as reverse fault concentrated along the backarc continental failed rift.