Variations in bend faulting and the nature of the incoming oceanic plate off northeast Japan arc

*Gou Fujie[1], Koichiro Obana[1], Yojiro Yamamoto[1], Tomoaki Yamada[2], Takehi Isse[2], Shuichi Kodaira[1], Seiichi Miura[1]

1. Japan Agency for Marine-Earth Science and Technology, 2. Earthquake Research Institute, Univ. of Tokyo

As the inputs to subduction zone, the nature of the incoming oceanic plate, such as relief, thermal state, lithology, and the water content, affects subduction zone processes, including arc magmatism and interplate and intraplate seismic activities. Thus, regional variations in the nature of the incoming oceanic plate have a potential to cause regional variations in such subduction zone processes.

To reveal the nature of the incoming oceanic plate and its regional variations off northeastern Japan arc, we have conducted extensive controlled-source seismic experiments at the northwestern margin of the oceanic Pacific plate. First, we conducted seismic experiments at around the junction of the Kuril and Japan trenches. We observed seismic structural changes owing to the plate bending-related faults just prior to subduction at both trenches and found the structural changes caused by bend faulting are more significant in the Japan trench side than that in the Kuril Trench side, indicating that plate hydration before subduction is remarkably higher in the Japan Trench than in the Kuril Trench. These observed differences can be explained by the type of the bend faults, newly created faults (Japan Trench) or reactivated abyssal-hill faults (Kuril Trench). As the type of bend faults are determined by the angle between the current trench and the ancient spreading ridge, this angle is one of key factors controlling the hydration of the incoming oceanic plate.

In 2017 and 2018, we conducted additional seismic experiment at the trench-outer rise areas of the southern Japan Trench off Fukushima. This was our first seismic survey in the trench-outer rise region of the southern Japan trench. The strike of the Japan trench differs between the northern part and the southern part, indicating that the angle between the current trench axis and the ancient spreading ridge also differs between the northern part and the southern part. In addition, unlike the northern part of the Japan trench, a large seamount chain exists in the trench-outer rise region of the southern Japan Trench. The primary aim of our new seismic survey in the southern part of the Japan Trench is to clarify the differences between the northern and the southern part of the Japan trenches.

We applied traveltime tomographic inversion to the wide-angle reflection and refraction seismic data and developed a P-wave velocity (Vp) model. The obtained Vp model clearly shows the reduction in Vp near the trench axis caused by bend faulting. The Vp reduction patterns are closely akin to that in the northern Japan trench area. The angle between the current trench and the ancient ridge axis differs between the northern and the southern Japan trench, but the type of bend faults are the same. Our new observation confirmed that the type of bend faults is a key controlling factor on the bend faulting and plate hydration prior to subduction.

In addition to the structural changes caused by bend faulting, we observed curious features in crustal Vp structure. In the area far from the trench axis off Fukushima, our Vp model shows velocity reversal within the oceanic crust which is suggested by the "shadow zones" of the crustal refractions. We have observed similar velocity reversal within the oceanic crust in the areas far off Iwate, but not in the areas far off Miyagi. These observations suggest that the oceanic crust are intrinsically inhomogeneous in the

northwestern part of the Pacific plate.

In this presentation, we will show the variations in the Vp model in the northwestern part of the Pacific plate including the structural changes caused by bend faulting and the velocity reversal within the crust, and discuss the possible impact as the subduction inputs.

Keywords: outer rise, controlled-source seismic survey, oceaic plate

