Regional variations in the nature of the incoming oceanic plate in the NW Pacific margin

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*藤江 剛[1]、小平 秀一[1]、Grevemeyer Ingo[3]、Morgan Jason[4]、山田 知朗[2]
*Gou Fujie[1], Shuichi Kodaira[1], Ingo Grevemeyer[3], Jason Morgan[4], Tomoaki Yamada[2]

1.海洋研究開発機構、2.東京大学地震研究所、3.GEOMAR、4.Royal Holloway, University of London
1.Japan Agency for Marine-Earth Science and Technology, 2.Earthquake Research Institute, University of Tokyo, 3.GEOMAR, 4.Royal Holloway, University of London

Various subduction zone processes, such as arc magmatism and generation of earthquakes, are directly or indirectly related to the nature of the subducting oceanic plate, indicating that the regional variations in the nature of the incoming oceanic plate may cause the regional variation of these subduction zone processes.
In the northwestern Pacific margin, the old oceanic Pacific plate (120Ma-130Ma) subducts beneath the northeast Japan arc. Many large interplate earthquakes has occurred in this subduction zone but their distribution are not uniform, suggesting that the interplate seismic coupling is not uniform along this subduction zone as pointed out by the geodetic studies.
The interplate seismic coupling is considered to be dependent on the materials that exist at the plate interface. For example, an ocean drilling after the 2011 Tohoku-oki earthquake (JFAST) revealed that the existence of the pelagic clay layer at the plate interface was a key to the large coseismic slip to the trench (Chester et al., 2013).
Several previous seisemic structure studies on the forearc region of this region pointed out large interplate earthquakes occured outside of areas with low seismic velocities and high Poisson's ratio along the plate interface (Wang and Zhao, 2006; Zhao et al., 2011; Fujie et al., 2013). Similarly, a thin layer with low seismic velocities identified at the depth of the plate interface in a region of low interplate microseismicity (Fujie et al., 2002; Mochizuki et al., 2005). These previous studies suggested that the nature of the incoming Pacific plate, especially its water content, is a key to understanding this regional variation in interplate seismicity.
Since 2009, to investigate structural variations in the incoming Pacific plate, focusing on the amount of water, we conducted extensive active source seismic surveys on the outer rise of the northwestern Pacific margin. We confirmed that seismic velocities gradually reduce and Vp/Vs ratio gradually increase toward the trench axis accompanied by the development of bend faults, suggesting the water penetration into the oceanic plate through the bend faults. In addition, we observed remarkable regional variations in the sediment thickness, crustal thickness, and seismic velocities within the crust and mantle before the area of bend faults.
In this paper, we are going to show these structural variations in the incoming plate and discuss the origin of the variations and possible effects on the subduction zone processes.

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