Structural variations of input oceanic lithosphere linked with subduction zone behaviors

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Subduction behaviors are believed to be attributed to various factors whcich may be controlled by structures and physical properties of input/subducting oceanic lithosphere. Among those factors, hydrous minerals and fluid pressuers are primary factors to influence on plate coupling as well as magmatic activities. For example, shallow megathrust earthquake and intermediated depth seismicity are controlled by dehydration from sediment and oceanic crust/mantle, respectively. Moreover, an interface between subductiong lithosphere and overriding mantle wedge is thought to be weakend by the presence of hydrous minerals. Although there have been many geodynamical, geochemical and petrological studies about dehydaritioin processes from subducting oceanic listhophere, yet fluid migration processes and volume of fluid input to subduction zones have not been well examined based of observed data. In order to study diversity and uniformity of structures and physical properties of incoming/subducting oceanic lithosphere to subduction zone, JAMSTEC have been carrying out active-passive seismic studies in the northwestern Pacific. Results from those studies show that 1) reduction of Vp and increase of Vp/Vs in the crust and the uppermost mantle from ~150 km seaward of the trench, 2) although a bending-relted fault is not clearly imaged, clear Moho reflection of the incoming plate is observed to the trench from the outer-rise with partially obscure Moho reflections, 3) some of clusters of the aftershocks of the 2011 Tohoku-oki earthquake, predominantly normal fault aftershocks, extend to deeper in the mantle (~40 km deep) in an area where the Moho reflection is obscure, and 4) comparing in the Japan Trench and Kuril trench, degree of the structural changes are more significant in the Japan Trench where higher intermediate depth seismicity is observed than that in the Kuril Trench. Those observations suggest that growing bend-related normal faults can be a primal mechanism to bring water down into a subduction zone, and this may influence earthquake activity in a subduction zone.