Sedimentation process and deformation process before sinking of sediment on oceanic plate: examples in northwest Pacific Ocean and Sumatra

*Kiichiro Kawamura[1]

1. Yamaguchi University

The sediments covering subducting oceanic plate are pressed into continents. Sometimes it forms an accretionary prism, and they may collapse into submarine landslides in some cases. Also, it may become a fault zone during the further subducting process. Thus, the sediment on the subducting oceanic plate plays an important role in the continental deformation process in the subduction zones. From the above viewpoint, it is a currently required research topic to compare sedimentological, mineralogical and mechanical characteristics of sediment on the subducting plate before and after subducting. In this paper, I report the characteristics of sediments before subducting in the Northwest Pacific and off Sumatra in detail.

As a sedimentary feature, in the northwest Pacific, the effect of the bottom current is large, and it appears in sediments and ocean bathymetry as shown below. In this area, the Pacific plate is subducting into the Izu-Ogasawara Trench on the south part, the Japan Trench and the Kuril Trench in the northern part. In this area, a strong north - south bottom current along the trench axis has been observed at about 6000 m in water depth (Lee et al., 2003, etc), from the north to the south on the land side (Owens and Warren, 2001). Furthermore, in the deep ocean of the Pacific Ocean, flow from west to east is reported (Fujio and Yanagimoto, 2005).

18 sediment samples have been collected using a 4-m piston corer system. The samples are composed mainly of diatomaceous hemipelagic clay and volcanic ash layers. The volcanic ash layer is dated using the glass refractive index measurement. Various sedimentary structures are found in the clay layer, and in particular, on the trench axis, eroded surfaces are seen, suggesting the influence of bottom currents along the trench axis. The effect of the bottom current also is detected in the magnetic susceptibility anisotropy data. In addition, it is suggested that topographical features by the bottom current is also found from an asymmetric depression and/or moat (depth of several tens of meters, width of several kilometers) around a knoll. Thus, from sediments and submarine topography, The sediment and topographic features would suggest that we could understand the predominant bottom current directions in the northwest Pacific during the geological time scale of several thousand years.

As a mechanical feature, burial consolidation and/or diagenesis are one of the important processes in sediments before subducting. It is known that when deposits are consolidated during burial, dehydration progresses in response to stress and the microstructure gradually changes accordingly. They are called to be a card house structure in the shallow part, a book house structure in the middle part, and a shale-like (preferred horizontally orientation) structure in the deep part. They would be proceed by creeping by particle rotation and sliding and are generally considered to be secondary consolidation that occurs after primary compaction caused by reduction of excess pore fluid pressure. Burial consolidation causes gradual hardening of sediments, but the rate of change of its mechanical properties varies depending on various factors such as deposition rate, geothermal gradient, pore water chemical composition, particle composition. For example, the shale-like structure occurs at an void ratio of about 1.0 in the input

sediments of the Izu-Ogasawara trench and occurs at about 0.5 off Sumatra. In addition, in the Izu-Ogasawara Trench and the input sediments off the coast of Sumatra, various deformation structures of the normal fault system are observed as a deformed structure before subducting.

By clarifying the sedimentary features such as the input sediments and the surrounding seabed topography, it is possible to interpret the difference of the deposition rate, the distribution area of the layer thickness of the sediment and so on. In addition, the mechanical characteristics represent the pre-additional deformation process before subducting, that is, in the area where the accretionary prism body is developing. The detailed characteristics of the sediments before subducting as described above will be important information for comparing deposits after subducting.

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