Magnetic fabric and stress status of accreting sediments at the toe of the Nankai prism

Toshio Hisamitsu[1], Kohtaro Ujiie[1]

[1] IFREE, JAMSTEC

Microstructures and initial grain components in sediments before accretion possibly affect on deformation style during first stage of accretion at the front of prism. Especially, sediments at the Nankai Basin located on the central to north west of the Philippine sea plate shows gradual change of their sedimentary components from trench-fill turbidite to hemipelagic mud facies along to increase of sedimentary depth. The contrast between sedimentary facies represents the history of sedimentary supply at the Nanklai Basin during the plate motion towards to Nankai Trough. To study grain alignments, the present status of physical properties and digenetic development in such various sedimentary facies will reveal to initial mechanism and processes of deformation in sand and hemipelagic mud at the toe of the Nankai prism.

Well-recovered core samples were obtained from seaward of the Nankai Trough during the cruise of ODP Leg 190. We investigated initial grain fabric and their evolution during accretion at the front of the prism based on comparison of anisotropy of magnetic susceptibility (AMS) and inner microstructure of sediments surveyed by SEM observation through the deformation front.

Grain fabric reflected by results of the AMS measurement, and physical properties measured on board suggest hemipelagic mud within the Upper Shikoku Basin has caused distinctive hardening without pore-filling before accretion. Also, slightly changes of the grain fabric and physical properties were discovered in sediment around proto-decollement zone at the Site 1173, drilled seaward end of the Trough as reference site for Site 1174 at the deformation front. From the fact of microstructural observation, it was clearly confirmed that development of clayey materials created by chemical diagenesis causes initial features of physical properties in hemipelagic sediment.

Direct comparison of anisotropy degree in magnetic susceptibility between deformed and un-deformed sediments can be estimated by precisely trace of sedimentary faces between both sites using results of microfossil and paleomagnetic stratigraphies. Stress and compaction status at both sites can be also estimated by calculation of the AMS parameters. Therefore, it is said that the differences of susceptibility anisotropies between both sites suggest changes in magnitudes of compaction and compression in sediments during deformation.

Hemipelagic sediments showing initial characteristics of clayey components, and trench-fill turbidite layers change their fabric and stress status just after accretion to the prism. About 1 to 2 percent of growth towards to lateral direction was observed within grain fabrics of turbidite and hemipelagic mud above the decollement zone. On the other hand, changes in anisotropy degree of hemipelagic mud below the decollement zone indicate they are in a condition of slightly high compaction.

Successful estimation of stress status in sediment suggests that initial grain fabrics of sediments affect on deformation mechanics and its processes at the front of the prism. Additionally, changes in anisotropy degree between Site 1173 and 1174 show the decollement zone makes boundary of stress status in sediments. Probably, these differences in stress status through the decollement zone may relate with initial setting of microstructures and grain fabrics before accretion.