Origin of the decollement at the Nankai accretionary prism, based on physical property and paleooceanographic analysis

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Grain fabric analysis at stress field such as an accretionary prism and seismogenic zone are needed to understand deformation processes of sedimentary rocks. Especially, Ocean Drilling Program (ODP) Leg 190 aim to understanding of deformation and fluid flow processes in the Nankai accretionary prism is expected to privides many details of information for progress of faults, thrusting and underthrusting mechanisms.

Investigation of magnetic fabric evolution during deformation at the toe of the Nankai accretionary prism is considered to be showing changes in grain fabric of hemipelagic sediments at the Nankai prism. Also comparison of the magnetic fabrics with physical properties of sediments will tell us why the decollement zone uses particular horizon (~6 Ma).

Analysis of magnetic fabrics using measurements of anisotropy of magnetic susceptibility around accretionary prisms has revealed dramatic changes in deformation styles of fine-grained sediments during accretionary processes. When we try to understand deformation mechanisms of sedimentary rocks, much details of information from sediments exposed at stress field such as accretionary prism should to be known. Because, visible active faults in sediments reflecting annulment of tectonic stress at seismogenic zone could be relating with specific structures and characteristic grain fabrics of sediments.

Previous investigation at the Nankai accretionary prism in ODP Leg 131 suggested there are mainly two different deformation processes are dominating in hemipelagic sediments above and below the decollement zone. Above the decollement, magnetic fabrics show prolate shaped ellipsoids considered to be reflecting physical shortening of grain fabrics resulted as almost horizontal compression of the sediments caused probably by tectonic movement of the Philippine Sea plate. On the other hand, highly oblate ellipsoids of magnetic fabric in samples obtained from below the decollement zone are reported, and are considered to be results of pure sedimentary compaction. To understand why such contrast of deformation processes had been developed at the toe of the Nankai accretionary prism, we investigated changes in magnetic fabric of about five hundred samples from two Sites (Site 1173 and 1174) of the Leg 190 at the Nankai Trough. And to know an evolution of magnetic fabrics around the prism, anisotropy of magnetic fabrics in accreted sediments consisting mainly of foliated mudstone at Site 1178 were compared with magnetic fabrics at the toe of the Nankai prism.

Changes in magnetic fabrics at Site 1173, reference site before development of the decollement zone, shows gradual increase of oblateness meaning flattening of magnetic fabrics, and suggest that sedimentary compaction dominates rather than lateral compression by accretionary motion of the sediments seen at Upper and Lower Shikoku Basin. After formation of the decollement zone, Site 1174, drastic changes in magnetic fabrics are observed at boundary between upper and lower decollement. Furthermore, a few high degree of anisotropy susceptibility were measured at some parts of hemipelagic sediments and turbidites above decollement zone. At the decollement zone, degrease of anisotropy degree was continuously observed except from basement of the decollement. From these results, it is probably say that semi-prolate shaped magnetic fabrics above decollement reflects horizontal shortening of the sediments had been caused by accretionry movements after formation of the decollement.

From comparison of these magnetic fabrics around the pre-decollement at Site 1173 and decollement zones at 1174 with physical property data measured on board, some changes in grain component similar to diagesis can probably be expected also around the decollement zone. Additionally, small fluctuation seen in degree of magnetic fabric and low anisotropy degree of anisotropy susceptibility at basement of decollement zone can be said as a result the decollement has been formed in relatively weak zone against horizontal stress. As a fact, it is known contrast of sediments makes great deformation boundary. ODP Leg 156 had revealed obvious sedimentary boundary relates strongly with development of decollement zone at Barbados accretionary prism. Therefore, same phenomena causing in sediments at the Nankai prism could be enough to possible. To know the possibility, microfossil classification and/or geochemical analysis will be performed.