Sedimentary structure of muddy turbidites recorded in a terminal basin

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Paleoseismic records of subduction zone are very important to mitigate great earthquake disaster. Terrestrial and marine archive analyses are necessary in order to gain long-term paleoseismic records in contrast to historical documents and ruins. Especially, marine sediments contain high quality pinpoint paleoseismic records because we can locate sampling sites close to epicenters. In order to obtain paleoseismic records from turbidite deposits, the samples should be carefully taken from the site without direct input of terrestrial sediments since turbidity currents are also derived from floods. Because such samples are dominant in fine-grained materials, we have to distinguish fine-grained turbidites from hemipelagic mud. The primary focus of this study is to understand the characteristic of sedimentary structure of seismogenic muddy turbidites already identified by the previous study. The second focus is to carry out detailed analytical and observational analysis of a longer sediment core collected at the same location and discuss the possible scenarios for the seismogenic turbidite distribution.
The samples used in this study include a 46 cm-long multiple core and a 6.7 m-long piston core which were collected from the sedimentary basin southeast off Kii Peninsula during the KS-14-8 R/V “Shinsei Maru” cruise. The sampling site is located at the ENE-WSW elongated basin between the accretionary prism and the Kumano forearc basin without terrestrial sediment supply. The basin exhibits “a terminal basin” that captures all sediments supplied from outside. From the multiple core sample, the Cs^{137} and Pb^{210} concentration indicate that the muddy sediment layer in the upper 17 cm was formed by the 2004 off the Kii Peninsula earthquake. We conducted visual observation, X-ray CT images, anisotropy of magnetic susceptibility (AMS), paleomagnetism, rock magnetism, electrical resistivity measurements and grain size analysis on both the cores.
Muddy seismogenic turbidite observed at the upper 17 cm of the multiple core have thick homogeneous clay layer above the silty lamination. The sequence beneath the muddy seismogenic turbidite shows various orientations oblique to the bedding plane suggesting shaking deformations during the 2004 earthquake. The magnetic susceptibility decreases upwards in the laminated zone. This specific feature suggested that the muddy turbidity current slowly decelerated and settled down the slope. Paleocurrent estimated from the paleomagnetic and AMS measurements is consistent with the slope orientation of the terminal basin. These characteristic features are also recognized in the piston core. From tephra chronology and radiocarbon dating of foraminifera, the interval of the probable seismic event layers almost matches the recurrence time of the known past earthquakes of the Nankai Trough area. In conclusion, the terminal basin is likely to hold most records of past seismic events in this region. Further age determination is required for understanding of the earthquake event history off Kii Peninsula.

Keywords: turbidity current, anisotropy of magnetic susceptibility, X-ray CT, event deposit

